

NERL/ESD Publications

Technical Information Manager: Chris Sibert (702) 798-2234

Jan 1, 2003 - Dec 31, 2003

Presented Published

ABSTRACT/ORAL

Holland, D.M., Chaudhuri, A., and Fuentes, M. Network design for ozone monitoring. Presented at: National Conference on Managing Environmental Quality Systems, New Orleans, LA, April 14-17, 2003.

4/14/2003

Contact: David M. Holland

Abstract: The potential effects of air pollution on human health have received much attention in recent years. In the U.S. and other countries, there are extensive large-scale monitoring networks designed to collect data to inform the public of exposure risks from air pollution. A major criterion for modifying an existing network is the suitability of spatial predictions based on site measurements at non-monitored areas. These spatial predictions can be used to develop better pollution control strategies for protecting human health. To accomplish this, it is important to ask what monitoring coverage is required to allow optimal, in some quantitative sense, predictions of the spatial field. We consider new approaches for network designs based on entropy criteria and modeling the underlying non-stationary covariance structure of atmospherically driven pollutant processes. In general, entropy is defined as maximizing "information" expected about potential non-monitored locations. Sites with observations near air quality standards are given higher priority in a combined entropy-air standard design criterion. Eight-hour daily maximum ozone values observed at 513 National Air Monitoring sites are used to demonstrate several network designs.

Holland, D.M., Caragea, P., and Smith, R.L. Trends in rural sulfur concentrations. Presented at: International Conference on Environmental Statistics and Health, Santiago, SP, July 16-18, 2003.

7/16/2003

Contact: David M. Holland

Abstract: As the focus of environmental management has shifted toward regional-scale strategies, there is a growing need to develop statistical methodology for the estimation of regional trends in air pollution. This information is critical to assessing the effects of legislated emission control programs. This paper presents an analysis of trends in atmospheric concentrations of sulfur dioxide (SO₂) and particulate sulfate (SO₄²⁻) at rural monitoring sites in the Clean Air Act Status and Trends Monitoring Network (CASTNet) from 1990 to 1999. A two-stage approach is used to estimate regional trends and standard errors in the Midwest and Mid-Atlantic regions of the U.S. In the first stage, a linear regression model is used to estimate site-specific trends in data adjusted for the effects of season and meteorology. In the second stage, kriging methodology based on maximum likelihood estimation is used to estimate regional trends and standard errors. This method is extended to include a Bayesian analysis to allow more accurate determination of the prediction error variance that accounts for uncertainty in estimating the spatial covariance parameters. For both pollutants, significant improvement in air quality was detected that appears similar to the large drop in SO₂ power plant emissions. Spatial patterns of trends in SO₂ and SO₄²⁻ concentrations vary by location over the eastern United States. Both spatial prediction techniques produced similar results in terms of regional trends and standard errors.

Holland, D.M., and Chaudhuri, A. Design of large-scale Air Monitoring Networks. Presented at: The International Biometric Society, Tampa, FL, March 30-April 2, 2003.

3/30/2003

Contact: David M. Holland

Abstract: The potential effects of air pollution on human health have received much attention in recent years. In the U.S. and other countries, there are extensive large-scale monitoring networks designed to collect data to inform the public of exposure risks to air pollution. A major criterion for modifying an existing network is the suitability of spatial predictions based on site measurements at non-monitored areas. These spatial predictions can be used to develop better pollution control strategies for protecting human health. To accomplish this, it is important to ask what monitoring coverage is required to allow optimal, in some quantitative sense, predictions of the spatial field. We consider new approaches for network designs based on entropy criteria and modeling the underlying nonstationary covariance structure of atmospherically driven pollutant processes. In general, entropy is defined as maximizing "information" expected about potential non-monitored locations. Sites with observations near air quality standards are given higher priority in a combined entropy-air standard design criterion. Eight-hour daily maximum ozone values observed at 513 National Air Monitoring sites are used to demonstrate several network designs.

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Presented Published

Matheny, R.W. Examining regional land use change: The Community Growth Model (CGM). Presented at: Urban Regional Information Systems Public Participation GIS Conference, Portland, OR, July 20-22, 2003.

7/20/2003

Contact: Ronald W. Matheny

Abstract: The U. S. Environmental Protection Agency's Regional Vulnerability Assessment Program (ReV A) is designed to develop and demonstrate approaches to identify the ecosystems at the greatest risk from regional population growth and economic activity. As part of this program, a cellular-based model is being developed to examine alternative land use patterns that could be influenced by policy changes. This presentation demonstrates various uses of the model to determine the conversion of forest and agricultural land uses to urban land uses under a variety of possible scenarios. The model itself examines possible policy changes in urban growth as reflected through the model spread equations, spontaneous growth equations and planned development assumptions. Concentration is placed on how the various model parameters can be modified by the decision-maker to analyze the implications of various land use policies. ReV A has used CGM to examine the population impacts in the Mid-Atlantic region and in the Neuse River Basin, and has completed baseline land use change projections by county for the entire Mid-Atlantic region. Using a series of population projections the Community Growth Model produces a grid that integrates infrastructure and land use. It then calculates the area to be converted to three urban uses (low density residential, high density residential and commercial/industrial/transportation) from the population projections. Next it allocates new urban growth using three variations of a neighborhood function. CGM iterates for each projected year.

Betowski, L.D., Enlow, M., Riddick, L.A., Collette, T.W., and D'Angelo, J.C. The modeling of the fate and transport of environmental pollutants. Presented at: Devils's Hole Workshop and Death Valley Regional Flow Model, Death Valley, CA, May 22, 2003.

5/22/2003

Contact: Leon D. Betowski

Abstract: Current models that predict the fate of organic compounds released to the environment are based on the assumption that these compounds exist exclusively as neutral species. This assumption is untrue under many environmental conditions, as some molecules can exist as cations, anions, zwitterions, or neutrals, depending on pH. Computational methods can assist in the improvement of these models by simulating the Raman spectra of a particular species. This is accomplished through frequency calculations using quantum mechanical programs like Gaussian, which calculates energies of compounds based on their molecular structures. These calculations give information about the frequency and motion/direction of the vibration. Researchers are able to use this data as a tool to help predict the measurement of simultaneously occurring species of environmental pollutants at varied temperatures and pH. A direct comparison is made between the calculated Raman frequencies and the experimental frequencies for four microspecies of meta-hydroxypyridine.

Edmonds, C.M., Heggem, D.T., Neale, A.C., Guidon, B., and Jones, K.B. A landscape ecology analysis of the Great Lakes Basin. Presented at: The 18th Annual Symposium of the International Association for Landscape Ecology, Alberta, Canada, April 2-6, 2003.

4/2/2003

Contact: Curtis M. Edmonds

Abstract: The U.S. Environmental Protection Agency (EPA) and Natural Resources Canada: Canada Centre for Remote Sensing (CCRS) are conducting a cooperative research landscape ecological study of the Great Lakes Basin. The analyses will include the areas located along the border of the United States and Canada. The study area is comprised of watersheds which drain or historically drained into the Laurentian Great Lakes. The Great Lakes contain 18 percent of the earth's fresh water and the ecosystem that surrounds the lakes is rich in streams, wetlands, forests, estuaries, breeding birds, biological diversity and many human population centers. The land cover for this analysis was primarily developed by the CCRS and is based on 1990s North American Landscape Characterization (NALC) imagery and the CCRS Multi-Spectral Scanner (MSS) archive imagery of Canada. The analyses will use delineated watersheds and mapping units of fixed size. The analysis will feature many landscape indicators including the percentage of natural land cover (N-Index), forest fragmentation and estimates of total nitrogen stream loading throughout the basin. This poster will demonstrate the development of the data set, conversion to land cover, the delineated watershed coverages and models for developing landscape scale ecosystem indicators. Data images are given in ranked order by natural breaks and will provide the viewer with ecosystem conditional relationships throughout the entire Great Lakes Basin. Results from this basic study by EPA and CCRS are presented and future work is expected to include change detection dating back to the early 1970s.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Edmonds, C.M., Heggem, D.T., Neale, A.C., and Jones, K.B. A regional ecological analysis of the Great Lakes Basin. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Curtis M. Edmonds

Abstract: The U.S. Environmental Protection Agency (EPA) and Natural Resources Canada: Canada Centre for Remote Sensing (CCRS) are conducting a cooperative research landscape ecological study of the Great Lakes Basin. The analyses will include the areas located along the border of the United States and Canada. The study area is comprised of watersheds which drain or historically drained into the Laurentian Great Lakes. The Great Lakes contain 18 percent of the earth's fresh water and the ecosystem that surrounds the lakes is rich in streams, wetlands, forests, estuaries, breeding birds, biological diversity and many human population centers. The land cover for this analysis was primarily developed by the CCRS and is based on 1990s North American Landscape Characterization (NALC) imagery and the CCRS Multi-Spectral Scanner (MSS) archive imagery of Canada. The analyses will use delineated watersheds and mapping units of fixed size. The analysis will feature many landscape indicators including the percentage of natural land cover (N-Index), forest fragmentation and estimates of total nitrogen stream loading throughout the basin. This poster will demonstrate the development of the data set, conversion to land cover, the delineated watershed coverages and models for developing landscape scale ecosystem indicators. Data images are given in ranked order by natural breaks and will provide the viewer with ecosystem conditional relationships throughout the entire Great Lakes Basin. Results from this basic study by EPA and CCRS are presented and future work is expected to include change detection dating back to the early 1970s.

Edmonds, C., Heggem, D.T., Neale, A.C., Jones, K.B., and Guindon, B. A regional ecological analysis of the Great Lakes Basin. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Curtis M. Edmonds

Abstract: The U.S. Environmental Protection Agency (EPA) and Natural Resources Canada: Canada Centre for Remote Sensing (CCRS) are conducting a cooperative research landscape ecological study of the Great Lakes Basin. The analyses will include the areas located along the border of the United States and Canada. The study area is comprised of watersheds which drain or historically drained into the Laurentian Great Lakes. The Great Lakes contain 18 percent of the earth's fresh water and the ecosystem that surrounds the lakes is rich in streams, wetlands, forests, estuaries, breeding birds, biological diversity and many human population centers. The land cover for this analysis was primarily developed by the CCRS and is based on 1990s North American Landscape Characterization (NALC) imagery and the CCRS Multi-Spectral Scanner (MSS) archive imagery of Canada. The analyses will use delineated watersheds and mapping units of fixed size. The analysis will feature many landscape indicators including the percentage of natural land cover (N-Index), forest fragmentation and estimates of total nitrogen stream loading throughout the basin. This poster will demonstrate the development of the data set, conversion to land cover, the delineated watershed coverages and models for developing landscape scale ecosystem indicators. Data images are given in ranked order by natural breaks and will provide the viewer with ecosystem conditional relationships throughout the entire Great Lakes Basin. Results from this basic study by EPA and CCRS are presented and future work is expected to include change detection dating back to the early 1970s.

Bradford, D.F. Factors implicated in amphibian population declines in the United States. Presented at: Declining Amphibian Populations Task Force, Southwestern U.S. Working Group, Tucson, AZ, March 10, 2003.

3/10/2003

Contact: Daniel T. Heggem

Abstract: Factors known or suspected to be adversely affecting native amphibian populations in the US were identified using information from 267 species accounts written in a standardized format by multiple authors in the forthcoming book, "Status and Conservation of U.S. Amphibians." Specific adverse factors were identified for 53 (58%) of 91 anurans and 93 (53%) of 176 caudates. Land use was the most frequently implicated adverse factor for both anurans and caudates. The predominant land use factors were agriculture, urban development, and timber harvest/silviculture, followed by road construction/use, livestock grazing, altered fire regime, recreational use/development, and mining. Exotic animal species were the second most frequently implicated adverse factor for anurans, and third for caudates. Exotic taxa implicated consisted of a number of introduced fishes, American bullfrogs, crayfish, defoliating insects, and other amphibians. Chemical contamination ranked third for anurans and second for caudates, and included acid precipitation, pesticides/herbicides, and mine water pollution. A regional analysis revealed that exotic species were implicated significantly more frequently among anurans in the western US than elsewhere, whereas chemical contamination was implicated significantly more frequently among caudates in the non-western US. Less frequently implicated factors were disease, water source modification, collecting/harvesting, and UV-B radiation.

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Presented Published

Heggem, D.T., and Edmonds, C. Landsat-based water quality monitoring of Pyramid Lake.
Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Daniel T. Heggem

Abstract: Pyramid Lake Paiute Tribe (PLPT) in cooperation with federal, state and local entities has been able to increase stream flow, establish water quality standards and improve fish habitat in the Truckee River, a primary source of water for pyramid Lake. In the past, pyramid Lake water quality has been affected adversely by noxious blooms of Nodularia (a blue-green alga). Nodularia fixes nitrogen from air and Truckee River inputs, and decomposition of the Nodularia is considered the primary source of total nitrogen to pyramid Lake. Blooms can occur in all parts of the pyramid lake from August to early November. Temporal Landsat imagery has been investigated as a tool for monitoring the abundance of Nodularia in pyramid Lake. Increases in Nodularia abundance have been associated with increases in near-infrared reflectance measure from Landsat (MSS). Temporal database of Landsat near-infrared reflectance has been used to monitor changes in Nodularia abundance and outbreaks. Results suggest that temporal Landsat MSS near-infrared reflectance data are effective for monitoring Nodularia dynamics.

Heggem, D.T., and Edmonds, C.M. Landsat-based water quality monitoring of Pyramid Lake.
Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

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Jones-Lepp, T. Unique chemistry solutions to regional issues. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Tammy L. Jones-lepp

Abstract: Many of ORD's research projects relate to broad scientific themes, such as biological and chemical indicators or computational toxicology. Others are discrete studies resulting from requests from or informal contacts with clients and collaborators. This poster presents a montage of five recent "grass roots" research efforts that the Environmental Chemistry Branch (ECB) at NERL-Las Vegas has conducted in response to real-world analytical chemistry problems of the Regions, the States, and Tribal Authorities. EP A Regions 2, 4, and 9 have requested help in identifying unknown compounds found in samples collected around Superfund sites. A unique software package (ion composition elucidation -ICE) developed by ECB scientists for high resolution mass spectrometry was used to determine the compositions of unknown and potentially toxic pollutants that were unresolved via conventional methodology. Region 2 needed to determine vinyl chloride (a known human carcinogen) in milk; instrumentation (vacuum distillation) developed in ECB for the multi-media determination of volatile organics was used to address this need. This led to a survey of MTBE and other volatile organics in milk from Nevada, Utah, Arizona, and California. One scientist is closely working with Tribal authorities and the State of Alaska to study the occurrence of mercury in indigenous food sources, using a recently developed method to determine mercury directly in solid matrices. ECB's scientists provided support, using state-of-the-art technologies (electrospray-ion trap mass spectrometry), to solve the source and fate of an industrial spill of organotins for the state of South Carolina. Region 9, the National Park Service, and others want to better understand regional air transport of pesticides, which could be implicated in the disappearance of the yellow-legged frog from the alpine lakes of the Sierra Nevada. Our chemists are working with other scientists within ORD and outside EP A to provide answers.

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Presented Published

Jones-Lepp, T. A new SW-846 method: Micro-liquid chromatography-electrospray/ion trap mass spectrometry as applied to the detection and identification of organotins - method 8323. Presented at: National Environmental Monitoring Conference (NEMC), Crystal City, VA, July 21-24, 2003.

7/21/2003

Contact: Tammy L. Jones-lepp

Abstract: There is a growing body of evidence that humans and other animals (terrestrial and marine) are being exposed continually to potentially harmful species of organotins. One possible route of environmental exposure in the U.S. to organotins (specifically dibutyltin and triphenyltin) is via fresh surface waters. A unique methodology (developed in-house at EPA-Las Vegas) was used for specific detection (speciation) and quantitation of the organotins. Method 8323 is the one of the newest EPA SW-846 methods and is the first EPA-approved method for organotins. This green-chemistry method uses solid-phase extraction discs, coupled with @L-liquid chromatography-electrospray/ion trap mass spectrometry (u-LC-ES/ITMS) as the detection method for the determination of organotins (as cations) in waters. This technique would also be applicable to ES-quadrupole mass spectrometry (ES-MS). The following compounds can be determined: tributyltin chloride, dibutyltin dichloride, monobutyltin trichloride, triphenyltin chloride, diphenyltin dichloride, monophenyltin trichloride. Applications of this method have been directed towards detecting organotins leaching from PVC pipe, natural waters, and an industrial spill in Region 4.

Jones-Lepp, T. Unique environmental chemistry solutions to superfund problems. Presented at: National Institute of Environmental Health Services, Washington, DC, June 11, 2003.

6/11/2003

Contact: Tammy L. Jones-lepp

Abstract:

Jones-Lepp, T. Unique chemistry solutions to regional issues. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Tammy L. Jones-lepp

Abstract: Many of ORD's research projects relate to broad scientific themes, such as biological and chemical indicators or computational toxicology. Others are discrete studies resulting from requests from or informal contacts with clients and collaborators. This poster presents a montage of five recent "grass roots" research efforts that the Environmental Chemistry Branch (ECB) at NERL-Las Vegas has conducted in response to real-world analytical chemistry problems of the Regions, the States, and Tribal Authorities. EPA Regions 2, 4, and 9 have requested help in identifying unknown compounds found in samples collected around Superfund sites. A unique software package (ion composition elucidation -ICE) developed by ECB scientists for high resolution mass spectrometry was used to determine the compositions of unknown and potentially toxic pollutants that were unresolved via conventional methodology. Region 2 needed to determine vinyl chloride (a known human carcinogen) in milk; instrumentation (vacuum distillation) developed in ECB for the multi-media determination of volatile organics was used to address this need. This led to a survey of MTBE and other volatile organics in milk from Nevada, Utah, Arizona, and California. One scientist is closely working with Tribal authorities and the State of Alaska to study the occurrence of mercury in indigenous food sources, using a recently developed method to determine mercury directly in solid matrices. ECB's scientists provided support, using state-of-the-art technologies (electrospray-ion trap mass spectrometry), to solve the source and fate of an industrial spill of organotins for the state of South Carolina. Region 9, the National Park Service, and others want to better understand regional air transport of pesticides, which could be implicated in the disappearance of the yellow-legged frog from the alpine lakes of the Sierra Nevada. Our chemists are working with other scientists within ORD and outside EPA to provide answers.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Rosal, C.G., Riddick, L.A., Heithmar, E.M., Momplaisir, G.-M., Varner, K.E., Ferguson, P.L., Bradford, D.F., and Tallent-Halsell, N.G. Analysis of low-level pesticides from high-elevation lake waters by large-volume injection GCMS. Presented at: Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy 2003, Orlando, FL, March 9-14, 2003.

3/9/2003

Contact: Charlita G. Rosal

Abstract: Pesticides are among the factors being proposed as causal agents for amphibian population declines in the Sierra Nevada range of California, USA. We hypothesize that agricultural pesticides applied in the San Joaquin Valley west of the mountains are volatilized or eroded, transported by near-surface winds, and deposited at high-elevation lakes of the Sierra Nevada in the Sequoia and Kings Canyon National Parks. We further hypothesize that the geographic pattern of pesticide deposition depends on the local air flow patterns and correlates with the extirpation of the mountain yellow-legged frog. Such a correlation would support the theory that pesticide exposure may have contributed to the disappearance of this species from some of its historic range. We intend to measure the concentrations of about 40 current-use pesticides in 60 or more lakes, to make the statistical analysis more robust. We anticipate the amounts of pesticides in our study sites to be lower than the detection limits of conventional analytical techniques. Our approach to achieving lower detection limits is to extract analytes from a large volume of water (the subject of a companion paper at this conference) and analyze a substantial fraction of the extract using large-volume injection (LVI) GCMS. This approach should result in a 100-fold increase in the amount of pesticide reaching the detector, compared with previous studies of pesticides in the Sierra Nevada. This paper will describe optimal LVI/GCMS conditions, present analytical figures of merit of the method, and compare its performance with that of GCMS with conventional pulsed-splitless sampling.

Rosal, C.G., Riddick, L.A., Heithmar, E.M., Momplaisir, G.-M., Varner, K.E., Ferguson, P.L., Bradford, D.F., and Tallent-Halsell, N.G. Analysis of low-level pesticides from high-elevation lake waters by large volume injection GCMS. Presented at: Pittsburgh Conference 2003, Orlando, FL, March 13, 2003.

3/13/2003

Contact: Charlita G. Rosal

Abstract: This paper describes the method development for the determination of ultra-low level pesticides from high-elevation lake waters by large-volume injection programmable temperature vaporizer (LVI-PTV) GC/MS. This analytical method is developed as a subtask of a larger study, background of which is summarized in a poster presentation Abstract # 1220-1 1, Tuesday, March 11, 2003. Compounds of interest include organophosphorus, organochlorine, carbamate, synthetic pyrethroid, and sulfonic acid pesticides as well as triazine, aniline, thiocarbamate, amide, phthalate, and substituted urea herbicides. We anticipate the amounts of pesticides in our study sites to be lower than the detection limits of conventional analytical techniques (i.e., pulsed-splitless GC/MS). Our approach to achieving lower detection limits is to extract analytes from a large volume of water and analyze a substantial fraction of the extract using LVI-PTV- GC/MS. This approach should result in a 100-fold increase in the amount of pesticide reaching the detector, compared with previous studies of pesticides in the Sierra Nevada. The large- volume sampling and extraction procedures are the subject of a companion paper at this conference (Abstract # 1220-1 1). This paper describes optimal LVI-PTV-GC/MS conditions, presents analytical figures of merit of the method, and compares its performance with that of GC/MS with conventional pulsed-splitless sampling. A pulsed-splitless GC/MS method was first developed and optimized for use as the reference for the LVI-PTV-GC/MS method development and optimization. The former method is also used in the analysis of the extracts produced during the extraction method development. For the same total amount injected (10 pg), preliminary results of the LVI-PTV-GC/MS method (20- μ L injection of 0.5 pg/ μ L pesticide standard mix) generally show analyte responses at greater than 100% higher than the responses produced by the pulsed-splitless GC/MS method (1- μ L injection of 10 pg/ μ L pesticide standard mix). Currently, limits of detection for the pulsed- splitless method are in the range of 0.6-15 pg/ μ L for the analytes of interest. These experiments were carried out on an Agilent GC 6890A and 5973N MSD with a Gerstel MPS-2 autosampler and CIS 3 injector.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Rosal, C.G., Riddick, L.A., Momplaisir, G.-M., Heithmar, E.M., and Varner, K.E. Pulsed splitless and large-volume injection in capillary Gas Chromatography Mass Spectrometry for the determination of Ultra-Trace Level Pesticide Residues. Presented at: National Environmental Monitoring Conference 2003, Arlington, VA, July 21-24, 2003.

7/21/2003

Contact: Charlita G. Rosal

Abstract: The possible presence of ultra-trace levels (sub- parts per trillion) of pesticides in pristine aquatic environments (e.g., alpine lakes) would raise questions regarding potential effects on biota. One hypothesis is that agricultural pesticides that are heavily applied in the San Joaquin Valley , California have drifted to the east of the valley, have been deposited along wind paths, and have reached high-elevation lakes of the Sierra Nevada. If so, these pesticides could be responsible for the disappearance of the mountain yellow-legged frogs. Conventional analytical techniques using gas chromatography/mass spectrometry (GC/MS) for the determination of these pollutants cannot detect sub-parts per trillion levels. In order to quantify ultra-trace levels of pesticides, it is necessary to develop an analytical method for accurate and reliable determination of these pollutants. Toward this end, this poster presents experimental results for two sample introduction techniques, pulsed splitless injection (PSI) and large-volume injection (L VI), into a capillary column GC/MS. PSI introduces 1 uL of sample into the inlet liner at a pulsed high pressure, while L VI slowly injects at least 20 uL of sample into the GC inlet liner at a temperature below the solvent's boiling point. Optimization of parameters and analytical figures of merit for the two techniques will be presented.

Varner, K.E., Momplaisir, G.-M., Tallent-Halsell, N.G., Bradford, D.F., Ferguson, P.L., Riddick, L.A., Rosal, C.G., and Heithmar, E.M. The challenge of acquiring alpine large volume lake water samples for ultra trace level analysis. Presented at: On-Site 11th International Conference, Phoenix, AZ, January 21-24, 2003.

1/21/2003

Contact: Katrina E. Varner

Abstract: The National Exposure Research Laboratory-Las Vegas, Nevada is interested in the emerging field technology of in-situ extraction of contaminants from surface water. A current research project involves ultra-trace level determination of agricultural pesticides from alpine lakes. The airborne transport of these chemicals from nearby agricultural land may be an important pathway for chemical stressors into the southern Sierra Nevada. Large-volume alpine lake water samples, of up to 1 00 liters, are collected and adsorbed on resin columns in the field. The analytes are then eluted and analyzed in the laboratory. The uniqueness of high volume sampling utilizing resin will be highlighted. The results of this Sierra Nevada Contaminant Research Project will contribute to the understanding of airborne transport of chemicals and of population declines of amphibians, as well as produce new analytical measurement tools that can be used to assess and protect pristine environments.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Daughton, C.G. Pollution from Personal Actions and Activities - Pharmaceuticals and Personal Care Products (PPCPs). Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Christian G. Daughton

Abstract: The occurrence of pharmaceuticals and personal care products (PPCPs) as trace environmental pollutants is a multifaceted issue whose scope of concerns continues to expand. PPCPs comprise thousands of distinct chemicals from numerous therapeutic and consumer classes. They typically occur as trace environmental pollutants (primarily in surface but also in ground waters) as a result of their widespread, continuous, combined usage in a broad range of human and veterinary therapeutic activities and practices. With respect to the risk-assessment paradigm, the growing body of published work has focused primarily on the origin and occurrence of these substances. Comparatively less is known about human and ecological exposure, and even less about the documented or potential hazards associated with trace exposure to these anthropogenic substances, many of which are highly bioactive and perpetually present in many aquatic locales. The continually growing, worldwide importance of freshwater resources underscores the need for ensuring that any aggregate or cumulative impacts on water supplies and resultant potential for human or ecological exposure be minimized. Of the many facets involved in this complex issue, that of sources/origins and environmental occurrence is the better understood end of the larger spectrum. The potential for adverse ecological or human health effects (especially from long-term, combined exposure to multiple xenobiotics at low concentrations) is the largest unknown. Beginning in the late 1990's, the Environmental Chemistry Branch (ECB) at NERL-Las Vegas became involved in several international activities involving PPCPs. This initial work has now evolved into a lead role at EPA. ECB's work is captured on the Agency's PPCPs web site (<http://www.epa.gov/nerlesd1/chemistry/pharma>), which is the only comprehensive site in the world devoted to this topic. The web site serves as a central point of access and major public outreach tool for a wide array of materials and information. ECB's role serves in part to catalyze research, and to foster collaborative efforts. In the span of the last 4 years, what had originally been a predominantly European-led effort, now involves researchers from other federal agencies (esp. CDC, FDA USDA, and USGS), other countries (e.g., Health Canada), and universities (e.g., EPA STAR grants targeted to PPCPs).

Daughton, C.G. Pharmaceuticals and Personal Care Products (PPCP's) as environmental pollutants: Pollution from personal actions. Presented at: U.S. EPA Region 5's Regional EPA-Tribal Environmental Conference (RETEC), Chicago, IL, March 4-6, 2003.

3/4/2003

Contact: Christian G. Daughton

Abstract:

Daughton, C.G. Pharmaceuticals and Personal Care Products (PPCP's) as environmental pollutants: Pollution from personal actions. Presented at: Special Meeting of U.S. EPA Region 5's Science Council (RSC), Chicago, IL, March 5, 2003.

3/5/2003

Contact: Christian G. Daughton

Abstract:

Daughton, C.G. Pharmaceuticals and Personal Care Products (PPCPs) as environmental pollutants. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Christian G. Daughton

Abstract:

Daughton, C.G. Environmental Stewardship of Pharmaceuticals - The Green Pharmacy. Presented at: National Ground Water Association (NGWA) 3rd International Conference on Pharmaceuticals and Endocrine Disrupting Chemicals in Water, Minneapolis, MN, March 19-21, 2003.

3/19/2003

Contact: Christian G. Daughton

Abstract:

Jan 1, 2003 - Dec 31, 2003

Presented Published

Daughton, C.G. PPCPs as ubiquitous pollutants from health and cosmetic care: significance, concern, solutions, stewardship. Presented at: EPA OPPTS-ORD Seminar Series, Washington, DC, July 16, 2003.

7/16/2003

Contact: Christian G. Daughton

Abstract:

Momplaisir, G.-M., Varner, K.E., Heithmar, E.M., Rosal, C.G., Riddick, L.A., Ferguson, P.L., Gentry, B., Bradford, D.F., and Tallent-Halsell, N.G. Determination of ultratrace concentrations of agricultural pesticides in water using solid-phase extraction and analysis by GC/MS. Presented at: Pittsburgh Conference on Analytical Chemistry and Applied Spectrometry, Orlando, FL, March 9-14, 2003.

3/9/2003

Contact: Edward M. Heithmar

Abstract:

A comprehensive study of the distribution of airborne agricultural contaminants in the Southern Sierra Nevada has been initiated, due to the heavy pesticide use in a neighboring area: the San Joaquin Valley of California. Approximately forty commonly used agricultural pesticides in the San Joaquin Valley are to be measured in lake water at about 60 sites in the Southern Sierra Nevada. This paper describes the development of an extraction procedure for the isolation of pesticides from large volumes of water (up to 100 L). Pesticide analytes are removed from the aqueous matrix by adsorption onto a solid phase sorbent, followed by sequential elution with organic solvents. The polymeric sorbent Nexus (Varian, Palo Alto, CA) offered more selectivity to the analytes than XAD and a silica-based material C₁₈. Also, when compared with the polymeric resin PPL, Nexus had a greater retention capacity. Recoveries of 80% or better were obtained for the majority of the compounds using the Nexus resin. Eight grams of sorbent were sufficient to displace the selected compounds from a 100-L water sample with minimal loss of the most polar compound dimethoate. The extracts were analyzed by conventional pulsed-splitless GC/MS or large-volume injection GC/MS (the subject of a companion paper at this conference). Because of the high organic contents of some lake water samples, a clean-up procedure was also developed. Preliminary data on the determination of agricultural contaminants in alpine lake waters of the Southern Sierra Nevada will be presented.

Neale, A.C., and Jones, K.B. CART diagnosis of watershed impairment in the mid-Atlantic region. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Anne C. Neale

Abstract:

Many factors (stressors) can lead to increased concentrations of nutrients and sediments, and these factors change across watersheds. Classification and Regression Tree (CART) is a statistical approach that can be used to "diagnose" which factors are important stressors on a per watershed basis. CART uses recursive partitioning to separate observations into groups. Numerous data sets were compiled for 477 watersheds in the mid-Atlantic region, including land cover, atmospheric deposition, hydrography, topography, and soils, along with nitrogen, phosphorus, and sediment loads. Results from the CART analysis identified 8 distinct groups of watersheds based on differences in the amount of atmospheric deposition, abundance of riparian land cover, abundance of forest land cover, and other factors.

Neale, A.C., and Jones, K.B. CART diagnosis of watershed impairment in the mid-Atlantic region. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

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Many factors (stressors) can lead to increased concentrations of nutrients and sediments, and these factors change across watersheds. Classification and Regression Tree (CART) is a statistical approach that can be used to "diagnose" which factors are important stressors on a per watershed basis. CART uses recursive partitioning to separate observations into groups. Numerous data sets were compiled for 477 watersheds in the mid-Atlantic region, including land cover, atmospheric deposition, hydrography, topography, and soils, along with nitrogen, phosphorus, and sediment loads. Results from the CART analysis identified 8 distinct groups of watersheds based on differences in the amount of atmospheric deposition, abundance of riparian land cover, abundance of forest land cover, and other factors.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Slonecker, E.T. The role of remote sensing and GIS in identifying buried World War I munitions at the American University, Washington, D.C.. Presented at: Brown Bag Seminar, Washington, DC, March 26, 2003.

3/26/2003

Contact: E. terrence Slonecker

Abstract: During World War I, The American University in Washington D.C. was used by the U.S. Army as an experiment station for the development and testing of a variety of battlefield munitions including chemical weapons such as Mustard Gas, Phosgene, Ricin and Lewisite, among others. After the end of the War in 1918, many of the weapons and chemical agents were haphazardly buried in and around the American University testing area which is now known as Spring Valley. In 1993, chemical-laden mortar shells were accidentally unearthed by a construction crew setting off a series of investigations that, to date, has cost over 40 million dollars and is still on-going. The Environmental Photographic Interpretation Center (EPIC) is supporting the on-going Superfund investigation efforts using both remote sensing and GIS technology. Both conventional and research applications of remotely sensed imagery, along with GIS database developments, are playing a critical role in the discovery and removal of chemical weapons and chemical contamination in this area. This presentation will document EPIC's use of historical imagery, GIS, photogrammetry and hyperspectral remote sensing in locating and removing these weapons and contaminants from the environment.

Slonecker, E.T. The emerging relationship between ground level ozone and landscape characteristics. Presented at: USGS Geographic Analysis and Monitoring Science Symposium, Nebraska City, NE, April 15-17, 2003.

4/15/2003

Contact: E. terrence Slonecker

Abstract: One of the most serious environmental health problems facing our society is that of poor air quality caused primarily by the formation of ground level ozone. Although natural ozone is beneficial in the upper atmosphere as a filter for ultraviolet radiation, ground-level ozone is primarily the result of anthropogenic activity and is the primary component of smog and poor air quality in urban environments. Washington D.C. is one of 14 cities with serious air quality problems and has, since 1990, been designated as an air quality, non-attainment area under the Clean Air Act. Ground level ozone is formed when precursor chemicals, originating mostly from vehicle emissions, react with heat and light to form the O₃ chemical bond. The landscape profile of dense urban environments of concrete and other 'impervious surfaces' create increased thermal profiles conducive to this reaction. From a regulatory standpoint, the monitoring and study of ozone is generally focused on Regional or Synoptic scales of management and study. However, readings from the past ten years from the 18 monitoring stations indicate that ozone formation is highly variable across the region. Funded under the 2002 USGS Geography Discipline Research Prospectus Grant, this paper presents some of the preliminary findings of the relationship of Ozone formation to landscape variables such as impervious surfaces, vegetation height and structure, building height and roof color. Some of these landscape relationships appear to be significant and have important implications to the study of urban air quality.

Garofalo, D. Remote Sensing for Environmental Compliance Monitoring. Presented at: Managing Technology 2003, Policy, Politics, and Leadership, Atlanta, GA, May 28, 2003.

5/28/2003

Contact: Donald Garofalo

Abstract: I. Remote Sensing Basics A. The electromagnetic spectrum demonstrates what we can see both in the visible and beyond the visible part of the spectrum through the use of various types of sensors. B. Resolution refers to what a remote sensor can see and how often. 1. Spatial resolution addresses the smallest feature size which can be seen or differentiated from an adjacent feature based on the sensor being used. 2. Spectral resolution refers to the spectral bands which a sensor is capable of detecting as well as band width. 3. Temporal resolution refers to the frequency with which remote sensing data are collected and the archival record available for a given sensor. 4. Photogrammetry is the art and science of making accurate measurements on remote sensing images; the technology is also used for making accurate maps from remote sensing data. C. Sensor types are varied. Selected sensor types are either active or passive. Radar is an active sensor because it generates and transmits its own source of electromagnetic energy which interacts with an object and is reflected back to the sensor for recording and analysis. Cameras, multi spectral and hyperspectral scanners, are passive devices which receive and record solar energy which has been reflected or transmitted from objects. Thermal scanners passively receive and detect temperature information being transmitted from hot or cold surfaces. Aerial Camera/Film is sensitive to the visible and near infrared (reflective, not thermal) portions of the electromagnetic spectrum, depending upon the type of film which is used in the camera. Radar is an active sensor which can be mounted on aircraft or spacecraft. Radar generates and records its own electromagnetic energy. It "shouts out" its signal and records the part of the signal which bounces off objects and is returned to the sensor.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Brilis, G.M., and Lyon, J.G. Remote Sensing/GIS and sound science. Presented at: Legal Applications of Geospatial Data and Information Conference, Tupelo, MS, April 16, 2003.

4/16/2003

Contact: George michael Brilis

Abstract: Protection of the environment is, in part, dependent on the quality of data used in decision making. Whether the decisions are part of the scientific process or relate to application of the laws governing people and their living conditions, good quality data are required/ needed by two disciplines with distinct differences. The presentation examines some differences between science and the law, provides a brief history of science in law, discusses the effects of law on science, compares RSGIS and U.S. Supreme Court credible science criteria and speculates on the future use of science data by the courts.

Kepner, W.G., Mueller, F., and Kutz, F.W. Landscape Sciences for environmental assessment: A NATO framework for international cooperation. Presented at: 6th International Association for Landscape Ecology World Congress, Darwin, Australia, July 13-17, 2003.

7/13/2003

Contact: William G. Kepner

Abstract: An international pilot study has been developed to explore the possibility of quantifying and assessing environmental condition, processes of land degradation, and subsequent impacts on natural and human resources by combining the advanced technologies of remote sensing, geographic information systems, spatial statistics, and process models with landscape ecology theory. This project has been established under the NATO Committee on the Challenges of Modern Society which has established a network of national experts within 46 countries in Europe and North America. The purpose of the study is to foster a framework for scientific cooperation which can lead to the transfer of technologies and information among the study group participants for their use in environmental protection and preservation programs.

Kepner, W.G., Hernandez, M., Semmens, D.J., Ebert, D.W., Goodrich, D., and Miller, S.N. Integrating landscape and hydrologic analysis for watershed assessment in an American Semi-arid Bioregion. Presented at: 6th International Association for Landscape Ecology World Congress, Darwin, Australia, July 13-17, 2003.

7/13/2003

Contact: William G. Kepner

Abstract: The objective of this study is to demonstrate the application of operational hydrologic modeling and landscape assessment tools to investigate the temporal and spatial effects of varying levels of anthropogenic disturbance in a semi-arid catchment and examine the consequences of landscape change on runoff volume and soil erosion. We integrated landscape metrics generated from readily available spatial data with a hydrologic model to examine the temporal and spatial effects of varying levels of anthropogenic disturbance between 1973 and 1997 in the Upper San Pedro River in southeastern Arizona. Landscape pattern analysis was conducted on a sub-catchment basis with emphasis on different levels of human use. Landscape metrics were associated with landscape characteristics, human stressors, and physical characteristics at each sub-catchment and for four temporal land use layers (1973, 1986, 1992, and 1997). Chronological changes were then examined relative to catchment condition variables using two hydrological models to perform multi-scale watershed assessment for a variety of outputs such as runoff depth, runoff discharge, and erosion rates at the sub-catchment scale. The results were particularly useful for assessing the effects of anthropogenic disturbance in the catchment area over a period of 25 years and for identifying sub-catchments that require critical management attention.

Kepner, W.G., Semmens, D.J., Goodrich, D., Mouat, D.A., and Bassett, S. Scenario analysis for the San Pedro River, analyzing hydrological consequences for a future environment. Presented at: Using Science to Assess Environmental Vulnerabilities - A ReVA MAIA Conference, King of Prussia, PA, May 13-15, 2003.

5/13/2003

Contact: William G. Kepner

Abstract: Studies of future management and policy options based on different assumptions provide a mechanism to examine possible outcomes and especially their likely benefits and consequences. The San Pedro River in Arizona and Sonora, Mexico is an area that has undergone rapid changes in land use and cover and subsequently is facing keen environmental crises related to water resources. It is the location of a number of studies that have dealt with change analysis, watershed condition, and most recently, alternative futures analysis. The previous work has primarily dealt with resources of habitat and groundwater related to human development patterns and preferences. In the present study, future options were examined relative to their impact on surface water conditions, e.g. sediment yield and surface runoff. These hydrological outputs were estimated for the baseline year of 2000 and predicted twenty years in the future using hydrological process models and spatially oriented land use models based on stakeholder preferences and historical growth.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Knight, J.F., Lunetta, R.S., Lyon, J.G., Mace, T.H., Paerl, H.W., and Peierls, B.L. Remote Sensing of Pamlico sound Plankton Communities using AVIRIS data. Presented at: EPA/NASA sponsored special session Remote Sensing of Water Quality ASPRS Annual Conference, Anchorage, AK, May 5-9, 2003.

5/5/2003

Contact: Ross S. Lunetta

Abstract: The U.S. EPA, in cooperation with NASA, NOAA and the University of North Carolina, has acquired AVIRIS hyperspectral data and high altitude (ER2) color infrared aerial photography (1: 65,000-scale) for the Pamlico Sound in North Carolina on May 15, 2002. The Pamlico Sound is a highly important fishery and recreational area that is impacted by urban growth, industry, and agriculture from the Neuse River Basin. The large size of the study area includes examples of a wide range of terrestrial and aquatic cover types in addition to varied estuarine environments ranging from sea grass beds to open water. Simultaneous in situ water quality samples, radiometric data, and aerosol optical depth measurements were also acquired. The objective of the project is to measure water quality parameters such as chlorophyll content, turbidity, and dissolved organic matter content from hyperspectral imagery in Case 11 waters. Additionally, project collaborators will conduct research to evaluate the potential application of advanced remote sensor technologies to measure indicators of estuarine health and condition that are currently under development across numerous estuarine systems for national application. Preliminary results linking AVIRIS reflectance measurements to water quality parameters will be presented.

Lyon, J.G., and Brilis, G.M. Remote Sensing/GIS: a strategic tool for environmental regulation and research. Presented at: Legal Applications of Geospatial Data and Information Conference, Tupelo, MS, April 16, 2003.

4/16/2003

Contact: John G. Lyon

Abstract: Protection of the environment is, in part, dependent on the quality of data used in decision making. Whether the decisions are part of the scientific process or relate to application of the laws governing people and their living conditions, good quality data are required/ needed by two disciplines with distinct differences. The presentation examines some differences between science and the law, provides a brief history of science in law, discusses the effects of law on science, compares RSGIS and U.S. Supreme Court credible science criteria and speculates on the future use of science data by the courts.

Lyon, J.G. Remote Sensing and GIS for Wetlands. Presented at: Annual Meeting of the American Society for Photogrammetry and Remote Sensing, Anchorage, AL, May 6, 2003.

5/6/2003

Contact: John G. Lyon

Abstract:

O'Connell, M., Smith, E.R., O'Neill, R.V., Tran, L.T., and Locantore, N. Integration of Spatial Data: Methods evaluation with regard to data issues and assessment questions. Presented at: EPA 22nd Annual National Conference on Managing Environmental Quality Systems, New Orleans, LA, April 14-17, 2003.

4/14/2003

Contact: Elizabeth R. Smith

Abstract: EPA's Regional Vulnerability Assessment (REVA) Program is developing and demonstrating approaches to assess current and future environmental vulnerabilities at a regional scale. An initial effort within this research program has been to develop and evaluate methods to synthesize existing spatial data on resource condition and sensitivity, and estimated stressor distributions to facilitate decision-making on alternative environmental policies or risk management strategies. A total of 9 methods, ranging from simple spatial overlays to estimates of changes in multivariate state space, have been tested with regard to sensitivity to data issues such as skewed distributions, continuous versus discontinuous data, and imbalance of indicators or metrics (e.g. a large amount of terrestrial data versus a small amount of aquatic data), as well as suitability for addressing different assessment questions. Utilizing available data for the Mid-Atlantic region over a total of 73 variables, testing was also done to identify whether different integration results were similar, or whether individual methods provide unique information and should be used in concert. The results of this analysis identifies potential limitations of methods due to data structure and suggests that assessment of vulnerabilities can best be accomplished using a suite of methods that rank on condition, vulnerability (risk of future damage), and risk management feasibility.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Smith, E.R. EPA's Regional Vulnerability Assessment Program (REVA) demonstrating results through partnerships. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Elizabeth R. Smith

Abstract: EPA's Regional Vulnerability Assessment (ReVA) program, a regional-scale comparative risk research effort, has been under development since 1998 with a pilot study focused on the Mid-Atlantic region. ReVA is part of the interagency Integrated Science for Ecosystem Challenges initiative that is focused on addressing broad-scale issues associated with land use change, resource extraction, pollution and pollutants, spread of non-indigenous species, and climate change. To date, ReVA has developed over 100 spatial coverages that depict the variability in resource condition, sensitivity, and current and future stressor distributions. In addition, we have developed new spatial integration methods and have evaluated both these new methods and traditional analysis methods with regard to data issues (skewness, imbalance, redundancy) and appropriateness for different assessment questions. A combination of regional-scale statistical and process models allow forecasting of the impacts of alternative management decisions along with insights into trends over which we have little to no control. Modeled results, spatial data coverages, and integration methods are all built into a web-based decision support system that allows flexibility in selecting and assessing different decision criteria. ReVA is now putting into place client partnerships with regional, state and local organizations to further develop our tools such that they are useful to decision-makers, and to test the application of ReVA data and information at multiple scales. Our partnerships now include EPA Region 3, The Pennsylvania Department of Environmental Protection, the Maryland Department of Natural Resources, The Canaan Valley Institute (covering the Mid-Atlantic Highlands region), and Baltimore County Department of Environmental Protection. Within all of these partnerships it is expected that we will demonstrate the application of ORD research towards targeting of risk management activities and evaluation of management alternatives.

Smith, E.R. Regional Vulnerability Assessment (ReVA) improving environmental decision making through client partnerships. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Elizabeth R. Smith

Abstract: The Regional Vulnerability Assessment (ReVA) Program is an applied research program that is focusing on using spatial information and model results to support environmental decision-making at regional- down to local-scales. ReVA has developed analysis and assessment methods to support multi- criteria decision-making; and tools and methods that can be applied with available monitoring and spatial data in any region and at any scale. Development and use of exposure models enable us to forecast the impacts of alternative environmental decisions allowing analysis of associated trade-offs that may not be apparent within short-term planning horizons and within the context of other changes that are occurring across the landscape (e.g. climate change impacts, resource extraction, spread of non-indigenous species). ReVA is now working directly with client partners to further develop and test our approaches and tools such that our research results contribute to desired outcomes that protect the environment while sustaining our quality of life. The goal of this session would be to communicate and demonstrate how these newly available approaches can support environmental decision-making at the various scales and to solicit input for further refining and testing ReVA methods and tools. Presentations from partners would potentially include Region 3 (Debra Forman, Acting Director, Environmental Data Division), Maryland Department of Natural Resources (Bill Jenkins, Director, Watershed Management and Analysis Division), Pennsylvania Department of Environmental Protection (possibly could get Katie McGinty, Deputy Secretary for the Environment; others have changed with change in administration so not sure of names), Baltimore County Department of Environmental Protection (Don Outen), and the Centralina Council of Governments (Rebecca Yarbrough, Program Administrator; alternatively Linda Rimer with R4, or Chris Stoneman, team leader for OAQPS Charlotte, NC/Rockhill, SC project). Additionally, a demonstration of our web-based decision-support system could be provided. Discussions will be led by Betsy Smith, ReVA program director.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Szykman, J., Williams, D.J., Kilaru, V., Fishman, J., Neil, D., Pierce, B., and Kitt, C. Utilizing satellite observations to expand EPA's Air Monitoring Network: A new partnership between NASA and EPA. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: David J. Williams

Abstract: Over the next decade, data requirements to inform air quality management decisions and policies will need to be expanded to large spatial domains to accommodate decisions which more frequently cross geo-political boundaries; from urban (local) and regional scales to regional, super-regional and international scales. Decisions and policies that involve these larger spatial scales will require data that can provide synoptic views of critical environmental variables. To a large degree, atmospheric chemistry models have filled this infrequent need in the past, but these models are resource intensive and coming to a consensus use of such models can be difficult. However, as the world moves toward a global economy, and the scientific fact that air pollution has no boundaries, the need for more frequent assessments to combat global air pollution will increase. The fact will remain that large ground level monitoring networks are impractical to implement on a global basis and present numerous issues. Over the past several years we have seen the emergence of trace gas and aerosol space-based measurements that can help provide these larger scale views for Air Quality assessments. Current instruments aboard US and European satellites can provide measurements of trace gases and aerosols relating directly to most of EPA's criteria pollutants (e.g., O₃, NO₂, SO₂, CO, and particulate matter [aerosols]). This poster will present an overview of tropospheric trace gas column products from instruments such as TOMS (Total Ozone Monitoring Spectrometer) and GOME (Global Ozone Monitoring Experiment), and aerosols from MODIS (Moderate-Resolution Imaging Spectroradiometer) and MISR (Multi-angle Imaging SpectroRadiometer). We will provide examples showing the utility of the data in conjunction with EPA's ground monitoring networks; discuss the enormous potential for the use of data from these instruments and future satellite instruments such as OM1 (Ozone Monitoring Instrument) and CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite) within EPA's air program; and identify how a new and emerging partnership between EPA and NASA can fulfill these needs.

Williams, D.J., and Friedl, L. Monitoring Ecosystems from space: The Global Fiducials Program. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: David J. Williams

Abstract: Images from satellites provide valuable insights to changes in land-cover and ecosystems. Long-term monitoring of ecosystem change using historical satellite imagery can provide quantitative measures of ecological processes and allows for estimation of future ecosystem condition. Global change research questions may be answered by identifying, monitoring, and analyzing a collection of specific ecosystems, or fiducials. A fiducial site is defined here as a geographic location to be used as an "environmental benchmark" or an environmentally-significant site for the long-term monitoring of processes, both natural and anthropogenic, associated with the causes or effects of environmental change. There is no specific criteria for what constitutes a fiducial site, but, the sites ideally support an environmental process that needs to be monitored over time so that scientists can better understand the changes that are occurring. Some sites are linked to other ongoing long-term ground based ecological research programs. The Global Fiducials Program is preparing an archive, or library, of satellite images to support current and future scientists and policy-makers. For the next 25 years, satellites will collect periodic images

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Szykman, J., Williams, D.J., Kilaru, V., Fishman, J., Neil, D., Pierce, B., and Kitts, C. Utilizing satellite observations to expand EPA's Air Monitoring Network: A new partnership between NASA and EPA. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

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Jan 1, 2003 - Dec 31, 2003

Presented Published

Wickham, J.D., and Riitters, K.H. How far to the nearest road?. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: James D. Wickham

Abstract: Increases in impervious surface area lead to declines in chemical and biological indicators of water quality. Roads are an important aspect of impervious surface, and distance to roads is an indicator of the potential threat to aquatic and terrestrial ecosystems. Although roads are expected to be common in urban settings, the pervasiveness of roads in rural ecosystems is not well appreciated. We combined national land cover (MRLC/NLCD) and road maps to measure the proportion of land area that was located within nine distances of the nearest road of any type, and summarized the results for 2,108 watersheds nationwide. Overall, 20% of the total land area was within 127 meters of the nearest road, and the proportion increased rapidly with distance such that 83% was within 1,061 meters of a road. Geographic regions with more than 60% of total land area within 127 meters of a road may be at greatest risk of cumulative ecological impacts from roads. Those regions include nearly all coastal zones as well as substantial portions of the southeast Piedmont, the southeast coastal plain, and the Ohio, Brazos, Colorado, San Joaquin, and Sacramento River basins. This research demonstrates how an interagency approach based on principles of landscape ecology and consistent national databases can be used to identify regions of the country at highest risk to road-mediate adverse impacts on aquatic and terrestrial ecosystems.

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Jarnagin, S.T., and Jennings, D.B. Use of LIDAR to map stream morphology and monitor changes due to urbanization of small suburban watershed. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: S. Taylor Jarnagin

Abstract: Urbanization has been associated with changes in stream flow regime, morphology, and water quality of rural watersheds being developed. Most studies of the effect of urbanization on stream morphology have been done post hoc -after development has occurred -and involve the extrapolation of limited stream transects (across-channel topography measurements) to monitor measure changes in stream morphology. We are using LIDAR imagery to construct a high-resolution, three-dimensional model of the topography of a small suburban watershed north of the Washington D.C. metropolitan area. This watershed is in the early stages of urbanization and LIDAR was obtained using a small aircraft to acquire the imagery during early winter (no snow and leaf-off) conditions. This imagery will be used to construct a baseline (pre-development) three-dimensional stream channel model. Subsequent LIDAR overflights will be obtained every three years or as the pace of development requires. These LIDAR acquisitions will allow for future three-dimensional stream channel models to be compared to the baseline model. We hope to spatially relate changes in stream morphology to specific patterns of development, storm sewer networks, and best management practices used while this watershed undergoes development. This project involves partnerships among the EPA, local units of government (Montgomery County Department of Environmental Protection), and local institutions of higher learning (University of Maryland, Baltimore County). The stakeholders who will realize benefits from in this project include the EPA Offices of Water and Research and Development, local units of government and private industry involved in the implementation and monitoring of best management practices to minimize the impacts of urbanization, and the general scientific community interested in the evaluation of this application of the emerging technology of LIDAR.

Jan 1, 2003 - Dec 31, 2003

Presented Published

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Contact: S. taylor Jarnagin

Abstract: Urbanization has been associated with changes in stream flow regime, morphology, and water quality of rural watersheds being developed. Most studies of the effect of urbanization on stream morphology have been done post hoc -after development has occurred -and involve the extrapolation of limited stream transects (across-channel topography measurements) to monitor measure changes in stream morphology. We are using LIDAR imagery to construct a high-resolution, three-dimensional model of the topography of a small suburban watershed north of the Washington D.C. metropolitan area. This watershed is in the early stages of urbanization and LIDAR was obtained using a small aircraft to acquire the imagery during early winter (no snow and leaf-off) conditions. This imagery will be used to construct a baseline (pre-development) three-dimensional stream channel model. Subsequent LIDAR overflights will be obtained every three years or as the pace of development requires. These LIDAR acquisitions will allow for future three-dimensional stream channel models to be compared to the baseline model. We hope to spatially relate changes in stream morphology to specific patterns of development, storm sewer networks, and best management practices used while this watershed undergoes development. This project involves partnerships among the EP A, local units of government (Montgomery County Department of Environmental Protection), and local institutions of higher learning (University of Maryland, Baltimore County). The stakeholders who will realize benefits from in this project include the EP A Offices of Water and Research and Development, local units of government and private industry involved in the implementation and monitoring of best management practices to minimize the impacts of urbanization, and the general scientific community interested in the evaluation of this application of the emerging technology of LIDAR.

Jarnagin, S.T., and Jennings, D.B. Use of LIDAR to map stream morphology and monitor changes due to urbanization of a small suburban watershed. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: S. taylor Jarnagin

Abstract: Urbanization has been associated with changes in stream flow regime, morphology, and water quality of rural watersheds being developed. Most studies of the effect of urbanization on stream morphology have been done post hoc -after development has occurred -and involve the extrapolation of limited stream transects (across-channel topography measurements) to monitor measure changes in stream morphology . We are using LIDAR (LIght Detection And Ranging) imagery to construct a high-resolution, three-dimensional model of the topography of a small suburban watershed north of the Washington D.C. metropolitan area. This watershed is in the early stages of urbanization and LIDAR was obtained using a small aircraft to acquire the imagery during early winter (no snow and leaf-off) conditions. This imagery will be used to construct a baseline (pre-development) three-dimensional stream channel model. Subsequent LIDAR overflights will be obtained every three years or as the pace of development requires. These LIDAR acquisitions will allow for future three-dimensional stream channel models to be compared to the baseline model. We hope to spatially relate changes in stream morphology to specific patterns of development, storm sewer networks, and best management practices used while this watershed undergoes development.

Grange, A.H., Thomas, P, Solomon, M., and Sovocool, G.W. Identification of compounds in South African stream samples using Ion Composition Elucidation (ICE). Presented at: 51st American Society for Mass Spectrometry Meeting, Montreal, CA, June 2-6, 2003.

6/2/2003

Contact: Andrew H. Grange

Abstract:

Jan 1, 2003 - Dec 31, 2003

Presented Published

Grange, A.H., Thomas, P., Solomon, M., and Sovocool, G.W. Identification of compounds in South African Stream Samples using Ion Composition Elucidation (ICE). Presented at: 51st American Society for Mass Spectrometry Meeting, Montreal, CA, June 8-12, 2003.

6/8/2003

Contact: Andrew H. Grange

Abstract: Analytical methods for target compounds usually employ clean-up procedures to remove potential mass interferences and utilize selected ion recording (SIR) to provide low detection limits. Such an approach, however, could overlook non-target compounds that might be present and that could pose risks to ecosystems or to humans. In an ideal world, it would be preferred that all compounds present be identified, quantified, and evaluated for toxicity. The US EPA's Environmental Chemistry Branch is identifying as many compounds as possible in several stream samples collected near Johannesburg, South Africa, using Ion Composition Elucidation (ICE), a high resolution mass spectrometric technique developed in-house. This SIR based technique measures the exact masses of an ion and its +1 and +2 mass peak profiles that arise from heavier isotopes such as ¹³C, ²H, ¹⁵N, ¹⁷O, ¹⁸O, ³³S, and ³⁴S. The abundances of the +1 and +2 profiles relative to the monoisotopic ion's profile are also measured for compounds that provide gas chromatographic peaks. Comparison of measured and calculated values of these three exact masses and two relative abundances for the ion compositions that are possible based on the ion's exact mass and its error limits provides unique compositions for the ions in a mass spectrum. Mass spectral interpretation based on these ion compositions often provides tentative identifications when multiple library matches occur, when poor quality mass spectra are obtained, or when no library matches are found.

Momplaisir, G.-M., Varner, K.E., Heithmar, E.M., Rosal, C.G., Riddick, L.A., Ferguson, P.L., Gentry, B., Bradford, D.F., and Tallent-Hallsell, N. Determination of Ultratrace concentrations of Agricultural Pesticides in water using solid-phase extraction and analysis by GC/MS. Presented at: Pittcon 2003, Orlando, FL, March 9-14, 2003.

3/9/2003

Contact: Georges-marie Momplaisir

Abstract: Pesticides are proposed as causal agents for amphibian population declines in the Sierra Nevada range of California, USA. We hypothesize that agricultural pesticides applied in the San Joaquin Valley west of the mountains are volatilized or eroded, transported by near-surface winds, and deposited in high-elevation lakes of the Sierra Nevada in Sequoia and Kings Canyon National Parks. We further hypothesize that the geographic pattern of pesticide deposition depends on the local air flow patterns and correlates with the extirpation of populations of the mountain yellow-legged frog. Such a correlation would support the hypothesis that pesticide exposure has contributed to the disappearance of this species from much of its historic range. We intend to measure the concentrations of about 40 current-use pesticides in 60 or more lakes. We anticipate the amounts of pesticides in our study sites to be lower than the detection limits of conventional analytical techniques. Our approach to achieving lower detection limits is to extract analytes from a large volume of water and analyze a substantial fraction of the extract using large-volume injection (LVI) GC/MS. This paper describes the development of the solid phase extraction procedure for the isolation of the pesticides from up to 100 liters of water. The polymeric sorbent Nexus (Varian, Palo Alto, CA) offered more selectivity adsorbed the analytes than XAD and a silica-based material C8. Also, when compared with the polymeric resin PPL, Nexus had a greater retention capacity. Several solvent systems were tested for elution of the analytes. Recoveries of 80% or better were obtained for the majority of the compounds using the Nexus resin. Eight grams of sorbent were sufficient to absorb the target compounds from a 100-L water sample with minimal loss of the most polar compound dimethoate. The extracts were analyzed by conventional pulsed-splitless GC/MS or large-volume injection GC/MS (the subject of a companion paper at this conference Abstract 2000-9; March 13, 2003 at 11:25 A.M.) Preliminary data on the determination of agricultural contaminants in alpine lake waters of the southern Sierra Nevada will be presented.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Pilant, A., Iliames, J., Lunetta, R.S., Endres, K., and Lewis, T. E. Satellite Remote Sensing and ground-based estimates of Forest Biomass and canopy structure. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Andrew N. Pilant

Abstract: MODIS (Moderate Resolution Imaging Spectroradiometer) launched in 1999 is the first satellite sensor to provide the kind of data necessary to intensively probe the global landscape for LAI. Because it is a new sensor, its data products must be validated with ground data. This research then has two goals; 1) Validate MODIS LAI and NDVI (Normalized Difference Vegetation Index) estimates using field measurements; 2) Develop improved methods for land-cover mapping and landscape change detection using remote sensing. We are using an emerging technology to measure LAI in the field: combined digital hemispherical photography and sunfleck profiling. This methodology captures geometric characteristics of canopy architecture that control the reflected sunlight signals received by satellite sensors. We have established a network of six validation sites in the Albemarle-Pamlico Basin of North Carolina and Virginia and lead a collaboration to collect the necessary data. NASA is providing satellite imagery, Duke University and North Carolina State University are providing access to well-studied field locales for instrument validation, industry partners Westvaco and International Paper provide access to forest land, as are the States of North Carolina and Virginia. In this poster we present the methodology used and example imagery showing trends in forest LAI.

Pilant, A., Iliames, J., Lunetta, R.S., Lewis, T. E., and Ediriwickrema, J. Linking in situ time series forest canopy LAI and phenology metrics with MODIS and Landsat NDVI and LAI products. Presented at: American Society for Photogrammetry and Remote Sensing Annual Conference and Exhibition, Anchorage, AK, May 5-9, 2003.

5/5/2003

Contact: Andrew N. Pilant

Abstract: The subject of this presentation is forest vegetation dynamics as observed by the TERRA spacecraft's Moderate-Resolution Imaging Spectroradiometer (MODIS) and Landsat Thematic Mapper, and complimentary in situ time series measurements of forest canopy metrics related to Leaf Area Index (LAI) and Normalized Difference Vegetation Index (NDVI). NDVI is related to ecosystem state, and LAI is an important input to ecosystem and landscape process models. Current research efforts involve development of remote sensing methodology for detecting landscape change and estimating LAI from satellite, particularly using time series analyses of MODIS data. The U.S. Environmental Protection Agency (EPA) has established a number of long-term forest research sites in the Piedmont and Coastal Plain of the Albemarle-Pamlico Basin of North Carolina and Virginia (USA). At each site, we conduct biophysical surveys of site composition and landscape character, as well as time series optical surveys of LAI at various phenological stages. LAI is estimated indirectly using combined hemispherical photography and TRAC (Tracing Architecture and Radiation of Canopies) optical surveys arranged in permanent grids and transects. This research focuses on two fundamental questions: (i) how can LAI be measured accurately and effectively in situ, and (ii) how can meter-scale field measurements be correlated with kilometer-scale MODIS geophysical products? We present initial results exploring relationships between the in situ LAI time series measurements and MODIS LAI and NDVI image products.

Pilant, A., Iliames, J., Lunetta, R.S., and Lewis, T. E. Satellite remote sensing and ground-based estimates of forest biomass and canopy structure. Presented at: Science Forum 2003, Washington, DC, May 5-6, 2003.

5/5/2003

Contact: Andrew N. Pilant

Abstract: MODIS (Moderate Resolution Imaging Spectroradiometer) launched in 1999 is the first satellite sensor to provide the kind of data necessary to intensively probe the global landscape for LAI. Because it is a new sensor, its data products must be validated with ground data. This research then has two goals; 1) Validate MODIS LAI and NDVI (Normalized Difference Vegetation Index) estimates using field measurements; 2) Develop improved methods for land-cover mapping and landscape change detection using remote sensing. We are using an emerging technology to measure LAI in the field: combined digital hemispherical photography and sunfleck profiling. This methodology captures geometric characteristics of canopy architecture that control the reflected sunlight signals received by satellite sensors. We have established a network of six validation sites in the Albemarle-Pamlico Basin of North Carolina and Virginia and lead a collaboration to collect the necessary data. NASA is providing satellite imagery, Duke University and North Carolina State University are providing access to well-studied field locales for instrument validation, industry partners Westvaco and International Paper provide access to forest land, as are the States of North Carolina and Virginia. In this poster we present the methodology used and example imagery showing trends in forest LAI.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Lopez, R.D., and Edmonds, C.M. Remote detection of invasive and opportunistic plant species in Great Lakes Coastal Wetlands. Presented at: U.S. EPA Science Forum, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Ricardo D. Lopez

Abstract: Invasive and opportunistic plant species have been associated with wetland disturbance. Increases in the abundance of plant species such as common reed (*Phragmites australis*) in coastal Great Lakes wetlands are hypothesized to occur with shifts toward drier hydrologic regimes, from other physical disturbances within or on the periphery of wetlands, or as a result of all of these factors. Hyperspectral remotely sensed data is being used to develop spectral signatures of *Phragmites*-dominated wetlands. Successful identification of *Phragmites* using hyperspectral data will permit region-wide mapping, and the mapping results can then be used to develop replicate samples to test the hypothesis that increases in *Phragmites* abundance are associated with hydrologic or other physical wetland disturbances. This project is also exploring the same capability for mapping purple loosestrife (*Lythrum salicaria*) and cattails (and *Typha* spp.)

Lopez, R.D., Edmonds, C.M., and Heggem, D.T. Landscape-scale ecological factors and their role in plant opportunism of Great Lakes Coastal Wetlands. Presented at: The 7th International Association of Ecology (INTECOL) International Wetlands Conference, Utrecht, The Netherlands, July 25-30, 2004.

7/25/2003

Contact: Ricardo D. Lopez

Abstract: Coastal wetlands of the Laurentian Great Lakes (USA and Canada) are among the most biologically diverse ecosystems of the world. However, since the 1970s the presence of opportunistic plant species such as common reed (*Phragmites australis* [Cav.] Steudel) have increased in Great Lakes wetlands, potentially diminishing biological diversity. Generally, decreases in wetland plant species diversity have been correlated with human-induced disturbances, including fragmentation from roads, urbanization, and agricultural development. Remote sensing and geographic information systems (GIS) offer unique capabilities to measure the type, extent, and physical characteristics of coastal wetlands, wetland plant communities, and human-induced wetland disturbance across vast regions. Thus, we developed and used a field-based vegetation assessment protocol in combination with satellite/airborne and GIS data analyses to test for ecological relationships between wetland disturbance and the presence and configuration of common reed stands in coastal wetlands of the Great Lakes. Plant community field measurements were conducted in thirteen representative wetlands within the coastal margin of the Great Lakes. Landscape-scale measurements were conducted throughout the Great Lakes basin to quantify wetland plant community composition; size and configuration of coastal wetlands; proximity to anthropogenic stressors and 'natural' land cover; and the potential effects of anthropogenic stressors and 'natural' land cover. The results describe differences among wetlands, differences among contributing watersheds, change along environmental gradients, and demonstrate how these relationships are being used to improve wetland conservation and management programs in the USA and Canada.

Lopez, R.D., and Edmonds, C.M. Remote detection of invasive and opportunistic plant species in Great Lakes Coastal Wetlands. Presented at: Science Forum 2003, Washington, DC, May 5-7, 2003.

5/5/2003

Contact: Ricardo D. Lopez

Abstract: Invasive and opportunistic plant species have been associated with wetland disturbance. Increases in the abundance of plant species such as common reed (*Phragmites australis*) in coastal Great Lakes wetlands are hypothesized to occur with shifts toward drier hydrologic regimes, from other physical disturbances within or on the periphery of wetlands, or as a result of all of these factors. Hyperspectral remotely sensed data is being used to develop spectral signatures of *Phragmites*-dominated wetlands. Successful identification of *Phragmites* using hyperspectral data will permit region-wide mapping, and the mapping results can then be used to develop replicate samples to test the hypothesis that increases in *Phragmites* abundance are associated with hydrologic or other physical wetland disturbances. This project is also exploring the same capability for mapping purple loosestrife (*Lythrum salicaria*) and cattails (and *Typha* spp.)

Jan 1, 2003 - Dec 31, 2003

Presented Published

Lopez, R.D., Edmonds, C.M., Jaworski, E., Neale, A.C., Jones, K.B., Heggem, D.T., Lyon, J.G., and Garofalo, D. Landscape-Scale monitoring of an opportunist: *Phragmites australis* (Cav) Steudel in Great Lakes Coastal Wetlands. Presented at: International Association for Landscape Ecology, Alberta, Canada, April 2-6, 2003.

4/2/2003

Contact: Ricardo D. Lopez

Abstract: Coastal wetlands of the Laurentian Great Lakes (LGL) are among the most fragmented ecosystems in the world, with a long history of human-induced disturbances, primarily as a result of agricultural conversions and hydrologic changes. A substantial number of remnant LGL coastal wetlands contain plant communities that are dominated by several opportunistic plant species, including the common reed *Phragmites australis* (Cav.) Steudel. In North America *P. australis* communities have become large and monospecific in many coastal wetlands, supplanting other plant taxa within the wetlands. Compared to wetlands with more heterogeneous plant communities, wetlands dominated by *P. australis* are less biologically diverse and provide less suitable habitat for other organisms. From an LGL resource management perspective, *P. australis* is considered a nuisance because it is persistent, produces large amounts of biomass, propagates easily, and is very difficult to control with mechanical or chemical techniques. Semi-automated remote-sensing techniques were used to map *P. australis* in ten coastal wetland regions of Lake Huron, Lake St. Clair, and Lake Erie. User's accuracy exceeds 90% for *P. australis* maps that describe areas of greatest stem density and greatest percent cover. Results of this study demonstrate how a combination of airborne remote-sensing and baseline ecological field sampling may improve the accuracy of mapping wetland vegetation, one of the least accurately mapped land cover classes. Because wetland biodiversity is an important component of ecosystem integrity and wetland field mapping is expensive, dangerous, and time consuming the semi-automated techniques described could improve the cost-effectiveness of wetland monitoring in the LGL. The techniques described also have potential applications in other plant communities, ecosystems, and regions.

Lopez, R.D., Edmonds, C.M., and Lyon, J.G. Hyperspectral Remote sensing, GPS, and GIS applications in opportunistic plant species monitoring of Great Lakes Coastal Wetlands. Presented at: American Society of Agricultural Engineers, Las Vegas, NV, July 27-30, 2003.

7/27/2003

Contact: Ricardo D. Lopez

Abstract: Coastal wetlands of the Laurentian Great Lakes (LGL) are among the most fragmented and disturbed ecosystems of the world, with a long history of human-induced disturbance. LGL wetlands have undergone losses in the biological diversity that coincides with an increase in the presence and dominance of several opportunistic plant species, including the common reed (*Phragmites australis*). Typically, *P. australis* communities form large monospecific "stands" that may predominate in wetland plant communities, supplanting other plant taxa. Compared to other more heterogeneous plant communities, *P. australis* stands are less suitable as animal habitat and reduce the overall biological diversity of wetlands. From a LGL resource perspective, *P. australis* is difficult to manage because it is persistent, produces a large amount of biomass, propagates easily, and is very difficult to control with mechanical or chemical techniques. We used a combined field and remote-sensing based approach to develop a semi-automated detection and mapping technique to support *P. australis* monitoring and assessment. Real-time- corrected GPS locations of field data provided an important measurable link between airborne sensor data and information about the physical structure of these plant communities, including physical structure of individual plants, soil type, soil moisture content, and the characteristics of other associated plant taxa. Ten LGL wetland sites on Lake Erie, Lake St. Clair, and Lake Huron were mapped in 2001, and resampled for mapping accuracy in 2002. User's accuracy of semi-automated maps for *P. australis* exceeds 90% at some of the wetland sites. The results of this study demonstrate a technique for combining hyperspectral airborne remote sensing data, precision GPS data, and GIS techniques to map plant species and plant community characteristics under ephemeral wetland conditions. Our results demonstrate how remote sensor technologies may offer effective semi-automated methods for monitoring opportunistic plant species over large geographic regions.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Lopez, R.D., Heggem, D.T., and Lyon, J.G. Broad-scale assessment of wetland vulnerability using GIS and landscape-ecological metrics. Presented at: American Society of Agricultural Engineers, Las Vegas, NV, July 27-30, 2003.

7/27/2003

Contact: Ricardo D. Lopez

Abstract: Landscape-ecological indicators of ecosystem integrity are increasingly being sought for use in habitat suitability assessments, habitat vulnerability assessments, and as a means to set goals for restoration projects. We utilized currently available information from the Arkansas GAP Program, Center for Advanced Spatial Technologies (CAST), and National Wetland Inventory (NWI) to determine the ecological vulnerability of wetlands in the Lower White River Basin (Arkansas). The documented ecological requirements of wetland species in the region were used to inform the merged GAP, CAST, and NWI habitat models for the 897,000 White River Basin study area. Wetland patch size, patch shape, and human-induced disturbance factors were used to determine the relative ecological vulnerability of wetland habitat for mallard duck, black bear, and plant species undercurrent and future landscape conditions. Results in the white River Basin indicate that a substantial proportion of wetland habitat is vulnerable to fragmentation or loss, as a result of patch configuration and/or human-induced disturbance factors. The models suggest that a future decrease in the occurrence or duration of wetland flooding along 226 kilometers of riparian habitat in the White River National Wildlife Refuge would result in the net loss of 2822 hectares of habitat for obligate-wetland or facultative-wetland organisms, in specific areas. The model results demonstrate that selected spectral remote sensing data, NWI data, and ecological principles can be combined to develop a practical ecological vulnerability model for wetlands at broad scales.

Lopez, R.D., Heggem, D.T., Edmonds, C.M., Jones, K.B., Bice, L., Hamilton, M.E., Evanston, E., Cross, C.L., and Ebert, D.W. Utilizing remotely sensed land cover to determine habitat vulnerability in Wetlands. Presented at: Spectral Remote Sensing of Vegetation Conference, Las Vegas, NV, March 14, 2003. 2003. R:\Ric Lopez\01_2002_SRSV_Poster_v4.pdf.

3/14/2003

Contact: Ricardo D. Lopez

Abstract:

Field, D., Biber, P., Kenworthy, W. J., Worthy, L.D., and Finkbeiner, M. Remote Sensing of Seagrass with AVIRIS and high altitude aerial photography. Presented at: American Society of Photogrammetry and Remote Sensing, Anchorage, AK, May 5-8, 2003.

5/8/2003

Contact: Lionel D. Worthy

Abstract: On May 15, 2002 AVIRIS (Advanced Visible/Infrared Imaging Spectrometer) data and high altitude aerial photographs were acquired for coastal waters from Cape Lookout to Oregon Inlet, North Carolina. The study encompasses extensive areas of seagrass, federally protected submersed, rooted vascular plants that perform a wide variety of beneficial physical and biological functions. Most seagrasses in the study area are well documented through earlier mapping efforts and extensive in situ studies. The AVIRIS and photographic imagery were processed for areas of known seagrass occurrence. The data were compared to evaluate the advantages and disadvantages of these two imagedata sources for mapping seagrass and detecting changes in such parameters as seagrass density and species composition. The AVIRIS data were also evaluated to determine the most efficient band combinations for seagrass detection in variably turbid class II inshore waters.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Werkema, D., Atekwana, E., Atekwana, E.A., Rossbach, S., and Sauck, W. Laboratory and field results linking high conductivities to the microbial degradation of petroleum hydrocarbons.

2/22/2003

Presented at: Symposium on the application of Geophysics to Environmental and Engineering Problems, Colorado Springs, CO, February 22-26, 2004.

Contact: Douglas D. Werkema

Abstract: The results of a 16-month field and 16-month meso-scale laboratory investigation of unconsolidated sandy environments contaminated by petroleum hydrocarbons that are undergoing natural biodegradation is presented. The purpose was to understand the processes responsible for causing the higher electrical conductivities observed at petroleum hydrocarbon contaminated sites. The results show that high conductivity, high microbial population numbers, shifts in microbial community dynamics, and elevated geochemical parameters all occur within the contaminated zone. Both investigations show that the highest conductivities occur within and slightly above the free-phase layer, not within the water saturated zone. Further analysis demonstrates highly elevated pore water conductivities within this conductive zone (~2-4 times background conductivity) as well as the maximum populations of oil degrading bacteria. The upper saturated zone reveals elevated concentrations of calcium and other ions suggesting enhanced mineral dissolution. These results suggest that the mechanism for the higher conductivity is directly or indirectly related to the microbial metabolism of the hydrocarbon and the resulting geochemical alterations within the contaminated zone. This study demonstrates the potential of geoelectrical investigations for assessing microbial degradation of hydrocarbon impacted sediments and the importance of meso-scale experiments for the interpretation of field data.

Werkema, D., Atekwana, E., Endres, A., and Sauck, W. Geoelectrical Stratigraphy and analysis of a hydrocarbon impacted aquifer. Presented at: Joint Assembly of the European Geophysical Society, and the American Geophysical Union and European Union of Geosciences Spring 2003 meeting, Nice, France, April 4-13, 2003.

4/4/2003

Contact: Douglas D. Werkema

Abstract: A recently proposed geoelectrical model for hydrocarbon impacted sites predicts anomalously high conductivities coincident with aged contaminated zones. These high conductivities are attributed to an enhancement of mineral weathering resulting from byproducts of microbial redox processes. To evaluate this model, high resolution in situ vertical bulk conductivity measurements were acquired from a mature light non-aqueous phase liquid (LNAPL) contaminated site. The geoelectrical stratigraphy showed conductivity maxima coincident with the free phase LNAPL zone, and occurring within the water table fluctuation zone. This zone is inferred as an active zone of biodegradation suggesting significant microbial degradation under partially saturated conditions. A simple Archie's Law analysis reveals that large pore water saturation and/or large pore water conductivity enhancements are necessary to produce the bulk conductivity observed at the contaminated locations. These results support the conductive model and demonstrate the potential of geoelectrical investigations for assessing microbial degradation of mature LNAPL impacted soils.

Werkema, D., Atekwana, E., Duris, J.W., and Rossbach, S. Microbial community structure in a shallow hydrocarbon-contaminated aquifer associated with high electrical conductivity. Presented at: Joint Assembly of the European Geophysical Society, and the American Geophysical Union and European Union of Geosciences Spring 2003 meeting, Nice, France, April

4/4/2003

Contact: Douglas D. Werkema

Abstract: Little is known about the complex interactions between microbial communities and electrical properties in contaminated aquifers. In order to investigate possible connections between these parameters a study was undertaken to investigate the hypothesis that the degradation of hydrocarbons by resident microbial communities causes a local increase in organic acid concentrations, which in turn cause an increase in native mineral weathering and a concurrent increase in the bulk electrical conductivity of soil. Microbial community structure was analyzed using a 96-well most probable number (MPN) method and rDNA intergenic spacer region analysis (RISA). Microbial community structure was found to change in the presence of hydrocarbon contaminants and these changes were consistently observed in regions of high electrical conductivity. We infer from this relationship that geophysical methods for monitoring the subsurface are a promising new technology for monitoring changes in microbial community structure and simultaneous changes in geochemistry that are associated with hydrocarbon degradation.

Jan 1, 2003 - Dec 31, 2003

Presented Published

BOOK CHAPTER

Rapport, D.J., Lasley, W.L., Rolston, D.E., Nielsen, N.O., Qualset, C.O., and Damania, A.B. "Land use change due to urbanization for the Mid-Atlantic integrated assessment region of the Eastern United States." In: Managing for Healthy Ecosystems, Chapter 76 Boca Raton, FL: Lewis Publishers 2003.

1/23/2003

Contact: Ronald W. Matheny

Abstract: The U.S. Environmental Protection Agency's (EPA) Regional Vulnerability Assessment Program (REVA) is designed to develop and demonstrate approaches to identify the ecosystems at the greatest risk from regional population growth and economic activity (Smith, 1999). A region is a multi-state area involving many metropolitan areas, drainage basins, associated ecosystems, and cultural infrastructures. The term vulnerability is a variable, ranging from no vulnerability to low and high vulnerability; without a qualifier, the term implies nothing. REVA is particularly used to compare risks arising from all sources of potential harm, acting alone or in combination, over the entire region. REVA is beginning with a pilot study conducted as part of the Middle Atlantic Integrated Assessment (MAIA). The study area includes all of Pennsylvania; Maryland; West Virginia; Virginia; the District of Columbia; and parts of North Carolina, Delaware, New York, and New Jersey. This area was selected because it has a wealth of ecological data collected by field surveys, remote sensing, and other ecological monitoring, modeling, and research activities. The study reported herein addresses two key questions: (1) What will be the land conversion to urban use and nitrogen loading during the next 5 to 25 years? and (2) Where are the most vulnerable ecosystems located? Immediate objectives are these: 1. Integrate multiple data sources and existing assessment technologies 2. Expand research to fill critical gaps in our ability to apply existing data at the regional scale 3. Incorporate socioeconomic research to better understand factors driving environmental change and to more accurately assess the true costs of environmental degradation REVA will test alternative approaches by applying the technology as it is developed to the MAIA and obtain feedback from decision makers at the regional and local levels and the public.

Daughton, C.G. "Chemicals from Pharmaceuticals and Personal Care Products." In: Water Sciences and Issues, Julius Dasch New York, NY: Macmillan 1, 2003, 158-164.

5/27/2003

Contact: Christian G. Daughton

Abstract: The use or consumption of natural resources often leads to ecological alteration. These changes can result from exposure of living systems to "stressors" ranging from physical alteration (such as habitat disruption) to chemical pollution. Untoward effects on wildlife and humans can range from the aesthetic to increased morbidity and mortality. This chapter focuses on a large class of chemicals designed for use by humans and domestic animals - Pharmaceuticals and Personal Care Products (PPCPs). While the benefits of these chemicals are undisputed and wide-ranging, the consequences of their release or escape to the environment are poorly understood. As early as the 1950s, the focus of environmental chemists had been agrochemicals (e.g., DDT) and industrial chemicals and wastes/by-products (e.g., polychlorinated biphenyls [PCBs] and dioxins) as the major sources of chemical pollutants in the environment. These toxic chemicals are frequently lipophilic (dissolving in fat), persistent (resisting environmental breakdown), and volatile (evaporating, subject to atmospheric transport) - properties giving these "conventional" pollutants the ability to concentrate in body fat (bioaccumulating in food chains) and to disperse globally. Despite the long, concerted attention afforded these conventional pollutants, it is not known what portion of total toxicity-risk they comprise. Indeed, many other classes of synthetic and naturally occurring toxicants can and do enter the environment.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Skirvin, S.M., Kepner, W.G., Marsh, S.E., Drake, S.E., Maingi, J.K., Edmonds, C.M., Watts, C.J., and Williams, D.R. "Assessing the accuracy of satellite-derived land cover classification using historical aerial photography Digital Orthophoto Quadrangles, and airborne video data." In: Remote Sensing and GIS Accuracy Assessment, Chapter 9 2003. EPA/600/A-03/066.

4/16/2003

Contact: William G. Kepner

Abstract: As the rapidly growing archives of satellite remote sensing imagery now span decades'worth of data, there is increasing interest in the study of long-term regional land cover change across multiple image dates. In most cases, however, temporally coincident ground sampled data are not available for accuracy assessment of the image-derived land cover classes, and other data and methods must be employed. The feasibility of utilizing historical aerial photography, digital orthophoto quadrangle (DOQ) images, and high-resolution airborne color video data to determine the accuracy of satellite derived land cover maps was investigated for a southwestern U.S. watershed. Satellite imagery included Landsat Multi-Spectral Scanner (MSS) and Landsat Thematic Mapper (TM) data acquired over an approximately 25-year period. This paper summarizes the results of three methods used to assess overall and individual accuracy for ten land cover classes for the upper San Pedro River watershed, in southeastern Arizona and northeastern Sonora, Mexico. Land cover maps were produced from classifications of MSS imagery (5 June 1973, 10 June 1986, and 2 June 1992) and TM imagery (8 June 1997). The MSS imagery was projected to Universal Transverse Mercator ground coordinates with a pixel size of 60 meters; the 30 meter TM imagery was re-sampled and mapped with a pixel size of 60 meters to facilitate comparison.

EPA PROCEED

Holland, D.M., Caragea, P., and Smith, R.L. Trends in rural sulfur concentrations. Presented at: International Conference on Environmental Statistics and Health, Santiago de Compostela, SP, July 16-18, 2003.

7/16/2003

Contact: David M. Holland

Abstract: This paper presents an analysis of regional trends in atmospheric concentrations in sulfur dioxide (SO₂) and particulate sulfate (PM_{2.5}) at rural monitoring sites in the Clean Air Act Status and Trends Monitoring Network (CASTNet) from 1990 to 1999. A two-stage approach is used to estimate regional trends and standard errors in the Midwest and Mid-Atlantic regions of the U.S. In the first stage, a linear regression model is used to estimate site-specific trends in data adjusted for the effects of season and meteorology. In the second stage, kriging methodology based on maximum likelihood estimation is used to estimate regional trends and standard errors. The method is extended to include a Bayesian analysis to account for the uncertainty in estimating the spatial covariance parameters. Both spatial prediction techniques produced similar results in terms of regional trends and standard errors.

Daughton, C.G. Pharmaceuticals and Personal Care Products in the environment introduction and overview. Presented at: U.S. EPA Emerging Pollutants Workshop, Chicago, IL, August 14, 2003. <http://www.epa.gov/nerlesd1/chemistry/pharma/index.htm>.

8/14/2003

Contact: Christian G. Daughton

Abstract: Pharmaceuticals and personal care products (PPCPs) occurring as environmental pollutants is a multifaceted issue whose scope continues to become better delineated with the escalation of concerted attention beginning in the 1980s, initially in Europe. PPCPs typically occur as trace environmental pollutants (primarily at ppb- ppt levels in surface waters but also in ground waters) as a result of their widespread, continuous, combined usage in a broad range of human and veterinary therapeutic and healthcare activities and practices. With respect to the risk-assessment paradigm, the growing body of published work has focused primarily on the origin, sources, and occurrence of these substances in the environment- this work being driven primarily by analytical chemists. Comparatively less is known about human and ecological exposure, and much less yet about the known or even potential hazards associated with exposure to these anthropogenic substances, many of which are designed to be highly bioactive.

Daughton, C.G. Pharmaceuticals and Personal Care Products in the environment: introduction and overview. Presented at: U.S. EPA Emerging Pollutants Workshop, Chicago, IL, August 11-14, 2003.

8/11/2003

Contact: Christian G. Daughton

Abstract:

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Presented Published

JOURNAL

Baumgardner, R.E., Isil, S., Lavery, T.L., Rogers, C., and Mohnen, V.A. Estimates of cloud water deposition at mountain deposition at Mountain Acid Deposition Program Sites in the Appalachian Mountains. Journal of Air & Waste Management Association 53 (3):291-308 (2003). EPA/600/J-03/234.

4/21/2003

Contact: Ralph E. Baumgardner

Abstract: Cloud water deposition was estimated at three high elevation sites in the Appalachian Mountains of the eastern United States (Whiteface Mountain, NY, Whitetop Mountain, VA, and Clingman's Dome, TN) from 1994 through 1999 as part of the Mountain Acid Deposition Program (MADPro). This paper provides a summary of cloud water chemistry, cloud liquid water content, cloud frequency, estimates of cloud water deposition of sulfur and nitrogen species, and estimates of total deposition of sulfur and nitrogen at these sites. Other cloud studies in the Appalachians and their comparison to MADPro are also summarized. Whiteface Mountain exhibited the lowest mean and median concentrations of sulfur and nitrogen ions in cloud water while Clingman's Dome exhibited the highest mean and median concentrations. This geographic gradient is partly an effect of the different meteorological conditions experienced at northern versus southern sites in addition to the difference in pollution content of air masses reaching the sites. AU sites measured seasonal cloud water deposition rates of SO_4 greater than 50 kg/ha and NO_3^- rates of greater than 25 kg/ha. These high elevation sites experienced additional deposition loading of SO_4^- and NO_3^- on the order of 6 to 20 times greater compared to lower elevation Clean Air Status and Trends Network (CASTNet) sites. Approximately 80 to 90% of this extra loading is from cloud deposition.

Sickles, II, J.E., and Grimm, J. Wet deposition from clouds and precipitation in three high-elevation regions of the Eastern United States. Atmospheric Environment 37 (2):277-288 (2003). EPA/600/J-03/076.

2/13/2003

Contact: Joseph E. Sickles, ii

Abstract: Three regions are identified in the eastern United States that contain substantial land area at high elevations: the Mid Appalachians, eastern New York state, and the New England region. Approximately 75% of the land cover in these areas is forested, with 5.6 to 29% of the total acreage above 600m and subject to cloud deposition. Measurements of cloud deposition are scarce. A six-year data record of measurements at two high-elevation locations is considered, and scaling factors are developed to enable the rough estimation of area-wide cloud deposition at various elevations in each region. Estimates of precipitation and associated ion deposition are made at 12 arc-second resolution for the eastern United States and are used to obtain elevation-resolved precipitation-mediated deposition for the three regions in question. At high elevations, clouds account for a substantial proportion of wet deposition (i.e., the sum of that from clouds and precipitation). For the total land area above 600m, clouds may account for 20 to 60% of the total wet ion deposition, with the exact proportion depending on both location and ion species. At elevations above 600m, but below the climatic tree line, the ratio of cloud- to precipitation-mediated deposition is higher in the New England region and eastern New York than in the Mid Appalachians. At the highest elevations of each study region clouds may account for over 80% of the wet ion deposition. Although the wet deposition of ammonium, sulfate, nitrate, and hydrogen ions is enhanced at higher elevations by clouds over precipitation, this enhancement is the largest for ammonium. This study illustrates the major and perhaps dominant role that clouds may play by delivering considerable ion loads to montane ecosystems in selected elevation ranges where these ecosystems may be especially vulnerable.

Sickles, II, J.E., and Shadwick, D.S. Biases in CASTNet filter pack results associated with sampling protocol. Atmospheric Environment 36 (29):4687-4698 (2003). EPA/600/J-03/027.

1/27/2003

Contact: Joseph E. Sickles, ii

Abstract: In the current study, single filter weekly (w) results are compared with weekly results aggregated from day and night (dn) weekly samples. Comparisons of the two sampling protocols for all major constituents (SO_4^{2-} , NO_3^- , NH_4^+ , HNO_3 , and SO_2) show median bias (MB) of < 5 nmol m⁻³ (0.1 ppb) and median relative bias (MRB) of < 10%. Examination of seasonal results reveal larger biases in some cases, especially during summer. Systematic discrepancies are observed for all constituents except for SO_4^{2-} . Composite dn results exceed the w results (in all cases except for the summer nylon HNO_3), and the magnitude depends on the constituent and on the season. To use CASTNet results for trends analyses, it may be useful to put all of the data on the same basis. Algorithms derived from linear regression analyses are offered to convert the recent results to a uniform basis. To improve accuracy, adjustments are indicated for summer Teflon NO_3 and nylon HNO_3 , and in each season for Teflon NH_4 and Total SO_2 . Nylon filters are also shown to have variable collection characteristics for SO_2 that are especially sensitive to humidity. A network-wide change in the SO_2 collection and/or retention characteristics for the nylon filters is found in April 1997.

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Presented Published

Sickles, II, J.E., and Shadwick, D.S. Precision of atmospheric dry deposition data from the clean air status and Trends Network (CASTNet). Atmospheric Environment 36 (36-37):5671-5686 (2003). EPA/600/J-03/028.

1/27/2003

Contact: Joseph E. Sickles, ii

Abstract: A collocated, dry deposition sampling program was begun in January 1987 by the US Environmental Protection Agency to provide ongoing estimates of the overall precision of dry deposition and supporting data entering the Clean Air Status and Trends Network (CASTNet) archives. Duplicate sets of dry deposition sampling instruments were installed adjacent to existing instruments and have been operated for various periods at 11 collocated field sites. All sampling and operations were performed using standard CASTNet procedures. The current study documents the overall precision of CASTNet data based on collocated measurements made at paired sampling sites representative of sites across the network. These precision estimates include the variability for all operations from sampling to data storage in the archives. Precision estimates are provided for hourly, instrumental ozone (O_3) concentration and meteorological measurements, hourly model estimates of deposition Velocity (V_d) from collocated measurements of model inputs, hourly O_3 deposition estimates, weekly filter pack determinations of selected atmospheric chemical species, and weekly estimates of V_i and deposition for each monitored filter pack species. Conservative estimates of variability of weekly pollutant concentrations, expressed as coefficients of variation, depend on species: NO_3^- - 8.1%; HNO_3 - 6.4%; SO_4^{2-} - 4.3%; NH_4^+ - 4.1%; SO_2 - 2.5%; and O_3 - 1.1%. Precision of estimates of weekly V_d from collocated measurements of model inputs also depends on the chemical species: HNO_3 - 6.3%; aerosols - 5.2%; SO_2 - 3.5%; and O_3 - 2.1%. Corresponding precision of weekly deposition estimates are: NO_3^- - 11.3%; HNO_3 - 10.5%; SO_4^{2-} - 6.2%; SO_2 and NH_4^+ - 5.9%; and O_3 - 3.1%. Weekly precision of concentration, V_d estimates, and deposition estimates are comparable in magnitude and slightly smaller than the corresponding hourly values. Annual precision estimates, although uncertain due to their small sample size, are consistent, but slightly smaller than corresponding weekly values.

Moy, T., and Brumley, W.C. MultiResidue determination of acidic pesticides in water by HPLC/DAD with confirmation by GC/MS using conversion to the Methyl Ester with Trimethylsilyldiazomethane. Journal of Chromatography 41:343-349 (2003). EPA/600/J-03/356.

8/14/2003

Contact: William C. Brumley

Abstract:

Brumley, W.C., and Farley, J.W. Determining eosin as a groundwater migration tracer by capillary electrophoresis/laser-induced fluorescence using a multiwavelength laser. Electrophoresis 24:2335-2339 (2003).

7/30/2003

Contact: William C. Brumley

Abstract: Groundwater migration remains an important contributor in determining the distribution and fate of environmental pollutants originating from various waste sites or in understanding fate and transport. [1-3]. Groundwater tracers are often used to determine the flow of groundwater. The tracers can be fluorescent dyes, in which case the use of synchronous scanning spectrofluorimetry is the technique of choice to determine the tracers in water or other samples. The U.S. EPA National Exposure Research Laboratory (Las Vegas) is interested in developing and applying 8 analytical tools that can strengthen the regulatory application of analysis. Among those tools under investigation is capillary electrophoresis/laser-induced fluorescence detection (CE/LIF), which is particularly well-suited to the analysis of water-soluble and fluorogenic compounds. Fluorescent dyes are a convenient choice for tracers because of the ease of sensitive detection. Spectrofluorimetry, high performance liquid chromatography (HPLC)/UV or fluorescence detection, and capillary LC/fluorescence detection have also been used [2-6]. For HPLC or capillary LC, the retention of dye analytes is enhanced using ion-pairing techniques. Logically, applications of capillary electrophoresis/laser-induced fluorescence (CE/LIF) detection should be ideal for the determination of anionic (or cationic) dyes. In free-zone CE, the dyes are separated very simply on the basis of their mobilities in aqueous buffers. Among several reports on CE/LIF detection techniques are two early papers based on high-sensitivity detection of fluorescent dyes [7,8] and more recent work applied directly to groundwater migration studies [9-12]. General reviews of environmental applications of CE and sample handling were published [13-14], and more recently updated reviews appear regularly [15]. Additional environmental

Jan 1, 2003 - Dec 31, 2003

Presented Published

Bradford, D.F., Neale, A.C., Nash, M.S., Sada, D.W., and Jaeger, J.R. Habitat patch occupancy by the toads (*Bufo punctatus*) in a naturally fragmented, desert landscape. *Ecology* 84 (4):1012-1023 (2003). EPA/600/J-03/266.

5/6/2003

Contact: Daniel T. Heggem

Abstract: Amphibians are often thought to have a metapopulation structure, which may render them vulnerable to habitat fragmentation. The red-spotted toad (*Bufo punctatus*) in the southwestern USA and Mexico commonly inhabits wetlands that have become much smaller and fewer since the late Pleistocene. This study tests two predictions based on metapopulation theory, i.e., the incidence of habitat patch occupancy is (1) directly related to patch size and (2) inversely related to patch isolation. In a 20,000 km² area of the eastern Mojave Desert, 128 potential habitat patches (primarily springs) were identified and surveyed for local environmental characteristics and presence/absence of *B. punctatus*. Patch size metrics reflected extent of water and riparian vegetation of several types. Patch isolation metrics were based on nearest neighbor distances, calculated both as Euclidian distance and distance via connecting drainage channels. *B. punctatus* was found at 72% of the sites, including 13 of 14 historic (pre-1970) sites. Patches were generally quite small, e.g., median linear extent of surface water was approximately 200 m (72 m² median area). Median nearest neighbor distances among patches were 1.8 km Euclidian distance (range: 0.4 - 22.0 km) and 6.8 km via drainage channels (range: 0.5 - 64.9 km). Based on stepwise logistic regression, incidence of patch occupancy significantly increased with patch size, including both water- and vegetation-based metrics. Patch occupancy was also significantly related to elevation, latitude, and four metrics that were associated with rocky terrain, periodic scouring water flows, and ephemeral water. In contrast, incidence of patch occupancy was not significantly related to patch isolation. These findings are consistent with a "patchy population" model, rather than the classical equilibrium metapopulation model, implying frequent dispersal among patches and virtually no local extinctions. However, application of the patchy population model is perplexing given the maximum known dispersal distances for *B. punctatus* (0.8 km) and *Bufo* spp. (2.6 km), which are well short of many of the observed nearest neighbor distances in this study.

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Presented Published

Daughton, C.G. Cradle-to-Cradle stewardship of drugs for minimizing their environmental desposition while promoting human Health Part I: Rationale and avenues toward a Green Pharmacy. Environmental Health Perspectives 111 (5):757-774 (2003). EPA/600/J-03/259, <http://www.epa.gov/nerlesd1/chemistry/pharma/index.htm>.

5/9/2003

Contact: Christian G. Daughton

Abstract: Since the 1980s, the occurrence of pharmaceuticals and personal care products (PPCPs) as environmental pollutants originating from consumer use and actions continues to become more firmly established. PPCPs typically occur as trace environmental pollutants (primarily in surface and ground waters) as a result of their widespread, continuous, combined usage by individuals and domestic animals. While occurrence data continue to be gathered, little is known regarding the environmental or human health hazards that might be posed by these bioactive substances. The continually growing, worldwide importance of water resources, however, underscores the need for ensuring that any aggregate or cumulative impacts on water supplies be minimized. Despite the paucity of effects data on long-term, simultaneous exposure to multiple xenobiotics (particularly PPCPs) at low doses, a wide range of proactive actions could be implemented in the near-term (and research initiated for the longer term) for reducing or minimizing the introduction of PPCPs to the environment. Most of these actions fall under what could be envisioned as a holistic stewardship program -- overseen by the healthcare industry and consumers alike. Significantly, such a stewardship program would benefit not just the environment --- additional benefits would automatically accrued including lessening medication expense for the consumer and improving patient health and consumer safety. This paper briefly summarizes the imperative for an ecologically oriented stewardship program for PPCPs - a holistic approach that accounts for the many facets of the overall issue. It then attempts to give a flavor for the broad spectrum of possible actions that could be implemented or researched to minimize the environmental disposition of PPCPs in general. The wide spectrum of actions available for minimizing the release of PPCPs to the environment has never been formulated in one document. Although the focus is on drugs, analogous actions could be implemented for personal care products. It is important to recognize that guidance for the responsible environmental disposition of PPCPs need not originate from regulators. A cohesive, scientifically sound set of guiding principles could be adopted by the industries involved with manufacturing, packaging, distribution, and purveyance of PPCPs -- principles that would also serve to influence or guide consumer actions. With its focus on pollution prevention (e.g., source elimination or minimization) via non-regulatory controls as opposed to conventional pollution control via federal standards and regulation, this paper is intended as a companion piece to the 1999 review article published in Environmental Health Perspectives that focused primarily on the origins and environmental occurrence of PPCPs (with an introduction to what little that is known about the potential for ecological effects). One of the major objectives of this paper is to generate an active dialog or debate across the many disciplines that must become actively involved to design and implement a successful approach to life-cycle stewardship of PPCPs -- an approach that not only minimizes their potential to impact the environment, but one that also improves medical healthcare outcomes for consumers and reduces healthcare costs. By focusing on developing a cultural mind set toward holistic environmental responsibility, rather than compliance to regulations, all aspects of society can play integral, productive and sustainable roles.

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Presented Published

Daughton, C.G. Cradle-to-Cradle stewardship of drugs for minimizing their environmental desposition while promoting human Health Part II: drug disposal, waste reduction, and future directions. Environmental Health Perspectives 111 (5):775-784 (2003). EPA/600/J-03/260, <http://www.epa.gov/nerlesd1/chemistry/pharma/index.htm>.

5/9/2003

Contact: Christian G. Daughton

Abstract: Since the 1980s, the occurrence of pharmaceuticals and personal care products (PPCPs) as environmental pollutants originating from consumer use and actions continues to become more firmly established. PPCPs typically occur as trace environmental pollutants (primarily in surface and ground waters) as a result of their widespread, continuous, combined usage by individuals and domestic animals. While occurrence data continue to be gathered, little is known regarding the environmental or human health hazards that might be posed by these bioactive substances. The continually growing, worldwide importance of water resources, however, underscores the need for ensuring that any aggregate or cumulative impacts on water supplies be minimized. Despite the paucity of effects data on long-term, simultaneous exposure to multiple xenobiotics (particularly PPCPs) at low doses, a wide range of proactive actions could be implemented in the near-term (and research initiated for the longer term) for reducing or minimizing the introduction of PPCPs to the environment. Most of these actions fall under what could be envisioned as a holistic stewardship program -- overseen by the healthcare industry and consumers alike. Significantly, such a stewardship program would benefit not just the environment -- additional benefits would automatically accrue, including lessening medication expense for the consumer and improving patient health and consumer safety. This paper briefly summarizes the imperative for an ecologically oriented stewardship program for PPCPs - a holistic approach that accounts for the many facets of the overall issue. It then attempts to give a flavor for the broad spectrum of possible actions that could be implemented or researched to minimize the environmental disposition of PPCPs in general. The wide spectrum of actions available for minimizing the release of PPCPs to the environment has never been formulated in one document. Although the focus is on drugs, analogous actions could be implemented for personal care products. It is important to recognize that guidance for the responsible environmental disposition of PPCPs need not originate from regulators. A cohesive, scientifically sound set of guiding principles could be adopted by the industries involved with manufacturing, packaging, distribution, and purveyance of PPCPs -- principles that would also serve to influence or guide consumer actions. With its focus on pollution prevention (e.g., source elimination or minimization) via non-regulatory controls as opposed to conventional pollution control via federal standards and regulation, this paper is intended as a companion piece to the 1999 review article published in Environmental Health Perspectives that focused primarily on the origins and environmental occurrence of PPCPs (with an introduction to what little that is known about the potential for ecological effects). One of the major objectives of this paper is to generate an active dialog or debate across the many disciplines that must become actively involved to design and implement a successful approach to life-cycle stewardship of PPCPs -- an approach that not only minimizes their potential to impact the environment, but one that also improves medical healthcare outcomes for consumers and reduces healthcare costs. By focusing on developing a cultural mind set toward holistic environmental responsibility, rather than compliance to regulations, all aspects of society can play integral, productive and sustainable roles.

Wershaw, R.L., Rutherford, D.W., Rostad, C.E., Garbarino, J.R., Ferrer-Felis, I., Kennedy, K.R., Momplaisir, G.-M., and Grange, A.H. Mass spectrometric identification of an azobenzene derivative produced by Smectite-catalyzed conversion of 3-amino-4-hydroxyphenylarsonic acid. Talanta 59 (6):1219-1226 (2003). EPA/600/J-03/195.

3/25/2003

Contact: Edward M. Heithmar

Abstract: We report here the first evidence of a possible mechanism for the formation of an azobenzene arsonic acid compound in the environment. The compound was formed when 3-amino-4-hydroxyphenylarsonic acid (3-amino-HPAA) was added to aqueous suspensions of smectite clay. The 3-amino-HPAA is a degradation product excreted by chickens that are fed rations amended with roxarsone. Roxarsone is used to control coccidial intestinal parasites in most of the broiler chickens grown in the United States. The structure of the azobenzene arsonic acid compound was first inferred from negative-ion and positive-ion low-resolution mass-spectrometric analyses of the supernatant of the smectite suspension. Elemental composition of the parent ion determined by high-resolution positive-ion mass spectrometric measurements was consistent with the proposed structure of the azobenzene arsonic acid compound.

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Presented Published

Tallent-Halsell, N.G., and Walker, L.M. Responses of *Salix Gooddingii* and *Tamarix Ramosissima* to flooding. *Wetlands* 22 (4):776-785 (2003). EPA/600/J-03/014.

1/27/2003

Contact: Nita G. Tallent-halsell

Abstract: Impoundments create artificial shorelines that differ from natural lake shorelines in patterns of water-level fluctuations, flow, sediment transport, and shoreline vegetation dynamics. Shoreline plant communities in the American Southwest often become dominated by mature, senescent *Populus* and *Salix*, with few if any seedlings. The failure of native plant community replacement is exacerbated by the fact that *Tamarix*, a prolific invader, is abundant on regulated rivers and occupies extensive areas along the shores of impoundments. Efforts to replant natives within the often-flooded drawdown zone surrounding Lake Mohave, a lower Colorado River impoundment bordering Nevada and Arizona, have not been successful. A greenhouse experiment was designed to examine the responses of cuttings of a native species, *Salix gooddingii* (Goodings willow), and the invasive species, *Tamarix ramosissima* (salt cedar), to different water levels comparable to those influencing Lake Mohave riparian plant communities. High survival and rapid growth under saturated but not flooded soil conditions demonstrated that both *Salix* and *Tamarix* cuttings can prosper in soils within the exposed drawdown zone, provided the shoots are not submerged. However, particularly rapid growth in *Tamarix* under conditions favorable to the native *Salix* also indicates that *Tamarix* invasion will have to be controlled. Revegetation efforts must include matching the natural hydrodynamics of the waterway to the requirements of native plant species.

Lunetta, R.S., Ediriwickrema, J., liames, J., Johnson, D, Lyon, J.G., McKerrow, A., and Pilant, A. A quantitative assessment of a combined spectral and GIS rule-based land-cover accuracy assessment in the Neuse River basin of North Carolina. *Photogrammetric Engineering and Remote Sensing* 69 (3):299-310 (2003). EPA/600/J-03/116.

3/5/2003

Contact: Ross S. Lunetta

Abstract: The 14,582 km² Neuse River Basin in North Carolina was characterized based on a user defined land-cover (LC) classification system developed specifically to support spatially explicit, non-point source nitrogen allocation modeling studies. Data processing incorporated both spectral and GIS rule-based analytical techniques using multiple date SPOT 4 (XS), Landsat 7 (ETM+), and ancillary data sources. Unique LC classification elements included the identification of urban classes based on impervious surfaces and specific row crop type identifications. Individual pixels were aggregated to produce variable minimum mapping units or landscape "patches" corresponding to both riparian buffer zones (0.1 ha), and general watershed areas (0.4 ha). An accuracy assessment was performed using reference data derived from in situ field measurements and imagery (camera) data. Multiple data interpretations were used to develop a reference database with known data variability to support a quantitative accuracy assessment of LC classification results. Confusion matrices were constructed to incorporate the variability of the reference data directly in the accuracy assessment process. Accuracies were reported for hierarchical classification levels with overall Level 1 classification accuracy of 82 percent (n=825) for general watershed areas, and 73 percent (n=391) for riparian buffer zone locations. A Kappa Test Z statistic of 3.3 indicated a significant difference between the two results. Classes that performed poorly were largely associated with the confusion of herbaceous classes with both urban and agricultural areas.

Tran, L.T., Knight, CG, O'Neill, R.V., Smith, E.R., Riitters, K.H., and Wickham, J.D. Fuzzy decision analysis for integrated environmental vulnerability assessment of the mid-atlantic region. *Journal Of Environmental Management* 29 (6):845-859 (2003). EPA/600/J-03/340.

6/25/2003

Contact: Elizabeth R. Smith

Abstract: A fuzzy decision analysis method for integrating ecological indicators is developed. This is a combination of a fuzzy ranking method and the Analytic Hierarchy Process (AHP). The method is capable ranking ecosystems in terms of environmental conditions and suggesting cumulative impacts across a large region. Using data on land-cover, population, roads, streams, air pollution, and topography of the Mid-Atlantic region, we are able to point out areas which are in relatively poor condition and/or vulnerable to future deterioration. The method offers an easy and comprehensive way to combine the strengths of fuzzy set theory and the AHP for ecological assessment. Furthermore, the suggested method can serve as a building block for the evaluation of environmental policies.

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Presented Published

Williams, D.J., O'Brien, T.M., Rybicki, N.B., and Gomez, R.B. Preliminary investigation of submerged aquatic vegetation mapping using hyperspectral remote sensing. Environmental Monitoring and Assessment 81 (1):383-392 (2003). EPA/600/J-03/194.

3/20/2003

Contact: David J. Williams

Abstract: The use of airborne hyperspectral remote sensing imagery for automated mapping of submersed aquatic vegetation in the tidal Potomac River was investigated for near to real-time resource assessment and monitoring. Airborne hyperspectral imagery, together with in-situ spectral reflectance measurements using a field spectrometer, were obtained for the pilot sites in spring and early fall of 2000. Field-based shoreline surveys for the study area determined SAV presence, species, and distribution. A spectral library database containing selected ground-based and airborne sensor spectra was developed for use in image processing. The goal of the spectral database is to automate the image processing of hyperspectral imagery for potential real-time material identification and mapping. Field based spectra were compared to the airborne imagery using the database to identify and map two species of SAV (*Myriophyllum spicatum* and *Vallisneria spiralis*). Overall accuracy of the vegetation maps derived from hyperspectral imagery was determined by comparison to a product that combined aerial photography and field based sampling at the end of the SAV growing season. Map accuracy was high and had very low false positive detections. The algorithms and databases developed in this study will be useful with the current and forthcoming space-based hyperspectral remote sensing systems.

Nash, M.S., Jackson, E., and Whitford, W.G. Soil microtopography on grazing gradients in Chihuahuan Desert Grasslands. Journal of Arid Environments 55 (1):181-192 (2003). EPA/600/J-03/354.

5/20/2003

Contact: Maliha S. Nash

Abstract: We tested the hypothesis that one of the significant impacts of livestock in the creation of piospheres centered on water points is the loss of soil microtopography. The size, height, and spatial distribution of micromounds and surrounding depressions were measured by a modified erosion bridge at three distances (50 m, 450 m, and 1050 m) from water points in desert grassland pastures in the Jornada Basin, N. M.. Plots at 50 m had fewer micromounds and the mounds were smaller than those recorded on the more distant plots. Microtopography of plots at 450 m from water was not significantly different from that recorded at 50m. Microtopography of plots that were 1050 m from water points was significantly different from that of plots nearer water points. Loss of microtopography from the impacts of livestock in piospheres exacerbates erosion processes and contributes to desertification.

Wickham, J.D., Wade, T.G., Riitters, K.H., O'Neill, R.V., Smith, J.H., Smith, E.R., Jones, K.B., and Neale, A.C. Upstream-to-downstream changes in nutrient export risk. Landscape Ecology 18 (2):193-206 (2003). EPA/600/J-03/338.

6/24/2003

Contact: James D. Wickham

Abstract: One of the early operating principles of landscape ecology was the importance of studying the movement of energy, nutrients, and biota in the horizontal or x,y plane (Risser et al. 1984). The new focus on horizontal movement was in part based on the recognition that many ecological studies had abstracted the horizontal domain (Reynolds and Wu 1999). Ecological risk assessment (O'Neill et al. 1982, Bartell et al. 1992, Suter 1993) emerged at about the same time as the field of landscape ecology, and focused on estimating the likelihood of an event (e.g., local extinction of a taxa). Ecological risk assessment developed as an extension of ecotoxicology (Truhaut 1977). Application of risk assessment to the field of ecotoxicology was based on the observations: (1) that manufactured chemicals were being produced too rapidly for study of biotic effects to keep pace (Maugh 1978), and (2) that laboratory testing to determine lethal concentrations did not necessarily accurately re-create an ecological microcosm that could be extended to an ecosystem level (O'Neill et al. 1982, Bartell et al. 1992). Some books on ecological risk assessment (Bartell et al. 1992, Suter 1993) close with discussions on how risk assessment might be applied to disciplines other than ecotoxicology, including landscape-scale studies. Richards and Johnson (1998) also discuss how ecological risk assessments fit within the context of landscape ecology. The few existing ecological risk assessments at a landscape-scale have focused on identifying spatial variation in risk across the x,y plane (Graham et al. 1991, Wickham and Wade in press, Wickham et al. in press). A horizontal, process-oriented perspective of landscape-level ecological studies (Reynolds and Wu 1999) suggests that propagation of risk in the xy plane should also be studied. Johnson (2000) investigated spatial propagation of toxic chemicals using organismal movement across the landscape - a landscape level ecotoxicology. Spatial propagation of nutrient export across watersheds provides a landscape-level perspective of nutrient transport.

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Presented Published

Riitters, K.H., Wickham, J.D., O'Neill, R.V., Jones, K.B., Smith, E.R., Coulston, J.W., Wade, T.G., and Smith, J.H. Fragmentation of Continental United States Forests. *Ecosystems* 5 (8):815-822 (2003). EPA/600/J-03/015.

1/27/2003

Contact: James D. Wickham

Abstract: We report a multiple-scale analysis of forest fragmentation based on 30-m land-cover maps for the conterminous United States. Each 0.09-ha unit of forest was classified according to fragmentation indices measured within the surrounding landscape, for five landscape sizes from 2.25 ha to 5314.41 ha. Most forest resided in fragmented landscapes. With 65.61-ha landscapes, for example, only 9.9 % of all forest was contained in a fully forested landscape, and only 46.9% was in a landscape that was more than 90% forested. Forest edge was located with 90 m of 43.5% of all forest, and within 150 m of 61.8% of all forest. Nevertheless, where forest existed it usually was dominant - 72.9% of all forest was in landscapes that were at least 60% forested for landscapes up to 5314.41 ha. Small (<7.29 ha) perforations in otherwise continuous forest cover accounted for about half of the fragmentation. These results suggest that forests are more or less connected over large regions, but also that fragmentation is so pervasive that edge effects potentially influence ecological processes over most forested lands.

Osemwengie, L., and Steinberg, S. Closed-loop stripping analysis (CLSA) of synthetic musk compounds from fish tissues with measurement by OC/MS/SIM. *Journal of Chromatography A* 993 (1-2):1-15 (2003). EPA/600/J-03/233.

4/30/2003

Contact: Lantis I. Osemwengie

Abstract: Synthetic musk compounds are used as inexpensive fragrance materials for the production of perfumes and as additives to soap, detergent, and shampoo. They have been found in surface water, fish tissues, and human breast milk. The ubiquity of this class of compounds in the environment is attributable to high use and release into the environment. Current techniques for separating these compounds from fish tissues require tedious sample clean-up procedures. To obtain fat-free extracts, gel permeation chromatography (GPC), column chromatography using alumina, and silica gel, and thin layer chromatography (TLC) clean-up procedures are frequently employed. Despite the considerable effort and resources devoted to these processes, a fraction of the lipids and lipid-like compounds frequently remains in the extracts. These low-level lipids foul injection liners, contaminate columns, and yield elevated baselines during gas chromatographic analysis of synthetic musk compounds. In this study, a simple method for the determination of synthetic musk compounds in fish tissues has been developed. Closed-loop stripping of saponified fish tissues in a 1-L Wheaton purge- and-trap vessel, is used to strip compounds with high vapor pressures such as synthetic musks from the matrix onto a solid sorbent (Absolut Nexus). This technique is useful for screening biological tissues that contain lipids for musk compounds. Analytes are desorbed from the sorbent trap sequentially with polar and nonpolar solvents, concentrated, and directly analyzed by high resolution gas chromatography coupled to a mass spectrometer operating in the selected multiple-ion monitoring mode. In this paper, we analyzed two homogenized samples of whole fish tissues with spiked synthetic musk compounds using either closed-loop stripping analysis (CLSA) or accelerated solvent extraction (ASE). The recoveries for the two techniques are presented.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Smith, J.H., Stehman, S.V., Wickham, J.D., and Yang, L. Effects of landscape characteristics on land-cover class accuracy. Remote Sensing of Environment 84 (3):342-349 (2003). EPA/600/J-03/083.

2/19/2003

Contact: Jonathan H. Smith

Abstract: Utilizing land-cover data gathered as part of the National Land-Cover Data (NLCD) set accuracy assessment, several logistic regression models were formulated to analyze the effects of patch size and land-cover heterogeneity on classification accuracy. Specific land-cover class relationships were established at both the level I and 11 classification schemes. Results indicate that the general pattern of the relationship between class accuracy and landscape structure was as expected: as heterogeneity increases, accuracy decreases, while as patch size increases, accuracy also increases. However, the magnitude of the effects of the variables varied by land-cover class resulting in some classes having patch size more important, while others had land-cover heterogeneity more important. Comparison of the results of the two classification schemes revealed that the heterogeneity odds ratios for the level I classes were smaller than those for the level 11 classes. In addition, their patch size odds ratios were greater than those at level 11. These results indicate that the level I classes are more sensitive to changes in the variables than the level 11 classes. Interaction between the two landscape variables was found to be significant for only a single class, indicating that the influence of heterogeneity was not impacted by the sample being in a small, or large patch. The information provided by the landscape variables remained significant even in the presence of regional dummy variables indicating that their impact was not due to regional differences in the mapping, assessment processes, or landscape characteristics. Results of these analyses provides land-cover class specific quantitative information useful for extracting classification error information for a location on the map based on that location's land-cover class, patch size and land-cover heterogeneity.

PUB REPORT

Heggen, D.T., Ebert, D.W., Wade, T.G., Evenson, E., and Bice, L. EMAP Western United States Landscape Characterization Northern California Data Browser. Las Vegas, NV: U.S. Environmental Protection Agency 2003. EPA/600/R-02/027, <http://www.epa.gov/nerlesd1/land-sci/projects.htm>.

3/25/2003

Contact: Daniel T. Heggen

Abstract: The United States Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) is conducting a pilot study in the western United States. This study will advance the science of ecological monitoring and demonstrate techniques for regional-scale assessment of the condition of aquatic resources in the 14 western states in EPA Regions 8, 9, and 10. This browser is a demonstration of a versatile communication device for our landscape ecological assessment products, reports, assessments, data studies, and analysis tools. Human stresses on the natural resources of the United States are intense. These pressures have resulted in many unintended changes in our ecosystems -- loss of biodiversity, increases in the number of endangered species (e.g. salmon), habitat degradation, and increases in contamination and pollution. Major public and private efforts have gone into controlling pollution, and protecting and restoring natural resources and the ecosystems they depend on. Corrective actions have, and will continue to have, an impact upon how we all lead our lives. We react to the problems that are most visible and thus receive the greatest amount of publicity. To make the most of our environmental efforts, we need to understand and assess the status and trends in the condition of our ecological resources and the stressors affecting these systems. It is not at all clear that we are currently targeting financial resources and/or lifestyle changes on problems or at locations where they will have the most effect. The landscape component of the Western Pilot Study provides information that has multiple management implications. Regional Landscape products will be provided to assess the spatial distribution of landscape stressors on aquatic ecosystems across each region. This will assist regional managers in understanding how landscape conditions contribute to varying aquatic resource conditions. As such, the products also will contribute to formulation of specific management actions for different geographic locations within each region. The first step in providing regional products will be to test and demonstrate landscape assessment methodologies on sub-regional areas of high importance to each Region. This browser concentrates on the Region 9 Northern California pilot area. Northern California Pilot Study Area. The Western EMAP Northern California Pilot Study Area (NCPA) is a contiguous tract of land located in the mountainous and coastal areas of the northwestern portion of the State of California and southernmost Oregon along all but the easternmost extent of the California-Oregon border. The NCPA occupies approximately 67,104 km² (25,909 mi²) in land area and is somewhat triangular in shape.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Heggem, D.T., Ebert, D.W., Wade, T.G., Hermann, K.A., Selle, T., Evenson, E., and Bice, L. EMAP Western United States landscape characterization southern rockies pilot study area data and product browser. Las Vegas, NV: U.S. Environmental Protection Agency 2003. EPA/600/R-02/024, <http://www.epa.gov/nerlesd1/land-sci/projects.htm>.

3/25/2003

Contact: Daniel T. Heggem

Abstract: The United States Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) is conducting a pilot study in the western United States. This study will advance the science of ecological monitoring and demonstrate techniques for regional-scale assessment of the condition of aquatic resources in the 14 western states in EPA Regions 8, 9, and 10 (shown below). This browser is a demonstration of a versatile communication device for our landscape ecological assessment products, reports, assessments, data studies, and analysis tools. Human stresses on the natural resources of the United States are intense. These pressures have resulted in many unintended changes in our ecosystems -- loss of biodiversity, increases in the number of endangered species (e.g. salmon), habitat degradation, and increases in contamination and pollution. Major public and private efforts have gone into controlling pollution, and protecting and restoring natural resources and the ecosystems they depend on. Corrective actions have, and will continue to have, an impact upon how we all lead our lives. We react to the problems that are most visible and thus receive the greatest amount of publicity. To make the most of our environmental efforts, we need to understand and assess the status and trends in the condition of our ecological resources and the stressors affecting these systems. It is not at all clear that we are currently targeting financial resources and/or lifestyle changes on problems or at locations where they will have the most effect. The landscape component of the Western Pilot Study provides information that has multiple management implications. Regional Landscape products will be provided to assess the spatial distribution of landscape stressors on aquatic ecosystems across each region. This will assist regional managers in understanding how landscape conditions contribute to varying aquatic resource conditions. As such, the products also will contribute to formulation of specific management actions for different geographic locations within each region. The first step in providing regional products will be to test and demonstrate landscape assessment methodologies on sub-regional areas of high importance to each Region. This browser concentrates on the Region 8 pilot area in the Southern Rocky Mountains of Colorado. Southern Rockies Pilot Study Area. The Western EMAP Southern Rockies Pilot Study Area (SRPSA) is contained completely within the State of Colorado and encompasses a significant and contiguous tract of land in the mountainous portions of the Front Range, South Central, and Southwestern regions of the state. The SRPSA is approximately 56,553 km² (21,835 mi²) in areal extent and is somewhat triangular in shape.

Heggem, D.T., Ebert, D.W., Wade, T.G., Augustine, S., Weiss, A.D., Evenson, E., and Bice, L. EMAP Western United States landscape characterization Northwest Oregon pilot study area data and product browser. Las Vegas, NV: U.S. Environmental Protection Agency 2003. EPA/600/R-02/023, <http://www.epa.gov/nerlesd1/land-sci/projects.htm>.

3/25/2003

Contact: Daniel T. Heggem

Abstract: The United States Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) is conducting a pilot study in the western United States. This study will advance the science of ecological monitoring and demonstrate techniques for regional-scale assessment of the condition of aquatic resources in the 14 western states in EPA Regions 8, 9, and 10 (shown below). This browser is a demonstration of a versatile communication device for our landscape ecological assessment products, reports, assessments, data studies, and analysis tools. Human stresses on the natural resources of the United States are intense. These pressures have resulted in many unintended changes in our ecosystems -- loss of biodiversity, increases in the number of endangered species (e.g. salmon), habitat degradation, and increases in contamination and pollution. Major public and private efforts have gone into controlling pollution, and protecting and restoring natural resources and the ecosystems they depend on. Corrective actions have, and will continue to have, an impact upon how we all lead our lives. We react to the problems that are most visible and thus receive the greatest amount of publicity. To make the most of our environmental efforts, we need to understand and assess the status and trends in the condition of our ecological resources and the stressors affecting these systems. It is not at all clear that we are currently targeting financial resources and/or lifestyle changes on problems or at locations where they will have the most effect. The landscape component of the Western Pilot Study provides information that has multiple management implications. Regional Landscape products will be provided to assess the spatial distribution of landscape stressors on aquatic ecosystems across each region. This will assist regional managers in understanding how landscape conditions contribute to varying aquatic resource conditions. As such, the products also will contribute to formulation of specific management actions for different geographic locations within each region. The first step in providing regional products will be to test and demonstrate landscape assessment methodologies on sub-regional areas of high importance to each Region.

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Presented Published

Heggem, D.T., Ebert, D.W., Wade, T.G., Augustine, S., Weiss, A.D., Evenson, E., and Bice, L.
EMAP Western United States landscape characterization Oregon data and product browser.
Las Vegas, NV: U.S. Environmental Protection Agency 2003. EPA/600/R-02/025,
<http://www.epa.gov/nerlesd1/land-sci/projects.htm>.

3/25/2003

Contact: Daniel T. Heggem

Abstract: The United States Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) is conducting a study in the western United States (EPA Regions 8, 9, and 10) that will advance the science of ecological monitoring and demonstrate techniques for regional-scale assessment of the condition of ecological systems. Human pressures on the natural resources of the United States are intense. These pressures have resulted in many unintended changes in our ecosystems -- loss of biodiversity, increases in the number of endangered species (e.g. salmon), habitat degradation, and increases in contamination and pollution. Major public and private efforts have gone into controlling pollution, and protecting and restoring natural resources and the ecosystems they depend on. Corrective actions have and will continue to have an impact upon how we all lead our lives. We react to the problems that are most visible and thus receive the greatest amount of publicity. To make the most of our environmental efforts, we need to understand and assess the status and trends in the condition of our ecological resources and the stressors affecting these systems. It is not at all clear that we are currently targeting financial resources and/or lifestyle changes on problems or at locations where they will have the most effect. To move toward an improved monitoring approach EPA has begun the Environmental Monitoring and Assessment Program (EMAP). EMAP is a research program that is used to develop the tools necessary to monitor and assess the status and trends of ecological systems. EMAP had its beginnings assessing the effects of acid deposition on large geographical areas of the U.S. during the 1980s. Out of that work came the concept of probability-based monitoring and the need for regional-scale assessments. EMAP's goal is to develop the scientific understanding for translating environmental monitoring data from multiple spatial and temporal scales into assessments of ecological condition. The landscape component of the Western Pilot study provides information that has multiple management implications. Regional Landscape Atlases and Landscape Data Browsers will be provided to assess the spatial distribution of landscape stressors on aquatic ecosystems across each region. This will assist regional managers in understanding how landscape conditions contribute to varying aquatic resource conditions. As such, the atlases also will contribute to formulation of specific management actions for different geographic locations within each region. The first step in providing regional atlases will be to test and demonstrate landscape assessment methodologies on sub-regional areas of high importance to each Region. State of Oregon Study Area. The State of Oregon is bounded by the Pacific Ocean on the west and the states of Nevada and California on the south, Washington on the north, and Idaho on the east. The study area includes all of Oregon and those portions of watersheds in Oregon which extend into each of the four states bordering it. In most cases, these "boundary watersheds" radiate out from Oregon less than 40 km (25 mi.) into its neighboring states; although, a few watersheds do reach considerably further into Nevada and Idaho.

Miller, S.N., Semmens, D.J., Miller, R.C., Hernandez, M., Miler, P., Goodrich, D., Kepner, W.G., and Ebert, D.W. Quality assurance and quality control in the development and application of the Automated Geospatial Watershed Assessment (AGWA) Tool. Las Vegas, NV: U.S. Environmental Protection Agency 2003. EPA/600/R-02/046 (NTIS PB2003-103047) ,
http://www.epa.gov/nerlesd1/land-sci/pdf/agwa_qaqc.pdf.

1/17/2003

Contact: William G. Kepner

Abstract: Planning and assessment in land and water resource management are evolving from simple, local-scale problems toward complex, spatially explicit regional ones. Such problems have to be addressed with distributed models that can compute runoff and erosion at different spatial and temporal scales. The extensive data requirements and the difficult task of building input parameter files, however, have long represented an obstacle to the timely and cost-effective use of such complex models by resource managers. The USDA-ARS Southwest Watershed Research Center, in cooperation with the U.S. EPA Office of Research and Development, has developed a GIS tool to facilitate this process. A geographic information system (GIS) provides the framework within which spatially-distributed data are collected and used to prepare model input files and evaluate model results. AGWA uses widely available standardized spatial datasets that can be obtained via the internet. The data are used to develop input parameter files for two watershed runoff and erosion models: KINEROS and SWAT.

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Presented Published

Smith, E.R., O'Neill, R.V., Wickham, J.D., Jones, K.B., Jackson, L.E., Kilaru, V., and Reuter, R.J.
The US EPA's regional vulnerability assessment program: A research strategy for 2001-2006.
Las Vegas, NV: U.S. Environmental Protection Agency 2003. EPA/600/R-01/008 (NTIS
PB2003-102734) , <http://www.epa.gov/nerlesd1/land-sci/ReVA/reva-strategy.pdf>.

4/2/2003

Contact: Elizabeth R. Smith

Abstract: The goal of ORD's Regional Vulnerability Assessment (ReVA) Program is to develop all approach to quantifying regional ecological vulnerabilities so that risk management activities can be targeted and prioritized. ReVA's focus is, to develop a set of methods that are applicable to the range of data available in regions (e.g., physiography, land use/cover change, change in climate, air pollution, non-indigenous species (NIS), the distribution and condition of resources, and others) and provide information to facilitate decision-making at the regional, watershed, and local scale. Information will be integrated to allow an assessment of the cumulative risks associated with multiple stressors on multiple resources, to identify the specific geographic areas of concern, and to evaluate the particular stressors that offer the greatest sources of vulnerability. The application of the tools developed by REVA should allow decision-makers to put environmental issues in perspective and will provide the spatial context necessary to improve decision making at the watershed and community level. ReVA's pilot study is focusing on the Mid-Atlantic region as part of the Mid-Atlantic Integrated Assessment (MAIA) (a federal, state and local partnership led by EPA Region 3). In future years, REVA will move to other regions of the US. As we have learned through ORD's ten-year involvement with The MAIA, a comprehensive integrated regional assessment involves many steps and incorporates data and research that focus on understanding ecosystem processes at a variety of scales. As MAIA has evolved, five distinct iterative steps to improving environmental decision-making have emerged: 1) monitoring to establish states and trends, 2) association analysts to suggest probable cause where degradation is observed, 3) prioritization of the role of individual stressors as they affect cumulative impacts and risk of future environmental degradation, 4) analysis of the trade-offs associated with future policy decisions, and 5) development of strategies to restore areas and reduce risk. The Environmental Monitoring and Assessment program (EMAP) is developing approaches to address steps one and two; REVA is developing approaches to address steps three and four. Approaches to address step 5 will be developed in a new research program that is under development. Based on EMAP and other monitoring data, MAIA has identified 5 groups of stressors that are implicated in the decline of ecological condition across the region. 1) land use change and population growth, 2) resource extraction, 3) pollution and pollutants, 4) non-indigenous invasive species, and 5) cumulative impacts from combinations of multiple stressors. Assessment of the risk associated with these stressors requires a regional approach that incorporates forecasts of anticipated distributions of these stressors. Similarly, evaluation of the potential impacts to regional resources requires analysis of the sustainability of goods, services, and other benefits they provide. REVA will develop exposure models that estimate current and future distributions of the 4 stressor groups as they relate to endpoints such as native biodiversity, resource productivity, and clean drinking water. ReVA will assess risk associated with these individual stressors as well as their potential cumulative effects. REVA will quantify effects associated with land use change and illustrate trade-offs associated with alternative policy decisions through future scenarios analysis.

Jan 1, 2003 - Dec 31, 2003

Presented Published

Nash, M.S., and Chaloud, D.J. Multivariate analyses (Cononical Correlation and Partial Least Square, PLS) to model and assess the association of landscape metrics to surface water chemical and biological properties using Savannah River Basin data.. Las Vegas, NV: U.S. Environmental Protection Agency 2003. EPA/600/R-02/091 (NTIS PB2003-106619).

1/21/2003

Contact: Maliha S. Nash

Abstract: Many multivariate methods are used in describing and predicting relation; each has its unique usage of categorical and non-categorical data. In multivariate analysis of variance (MANOVA), many response variables (y's) are related to many independent variables that are categorical (classes, levels). For example, relating nitrogen, phosphorous and fecal coliform to presence/absence of urban development, farm, soil types, geological formations, etc, (nitrogen + phosphorous + fecal coliform = type of farm, urban development, geology, soil, ...). In analysis of variance (ANOVA), a dependent (response) variable is related to many independent variables that are categorical. For example, determining the response of an ant species to grazing level (severe, medium, low) in an area (ant abundance = grazing levels). In multiple discriminant analysis the dependent variable (Y) is categorical (groups or classes) and related to the independent variables (x's). For example, presence/absence of amphibians in an area relates to many environmental variables (pres/abs = percent bedrock substrate cover + water depth + percent vegetation cover + ...). In multiple regression the dependent variable (Y) is related to many independent variables (x's). For example nitrogen loading relates to landscape metrics such as percent forest, percent crops, percent of wetland, percent of urban development. In canonical correlation, two sets of variables are related and these variables may or may not be categorical. So it is a generalized multivariate statistical technique in respect to that described above, and is directly related to principal components-type factor analytic models. In canonical analysis method, a number of composite associations between sets of multiple dependent and independent variables are performed. Consequently, a number of independent canonical functions that maximize the correlation between the linear composites of sets of dependent and independent variables are developed. The main goal of the canonical correlation analysis is to develop these linear composites (canonical variate), derive a set of weights for each variate, thereby explaining the nature of relationships that exist between the sets of response and predictor variables that is measured by the relative contribution of each variable to the canonical functions (relationships) that exist. The results of applying canonical correlation is a measure of the strength of the relationship between two sets of multiple variables. This measure is expressed as a canonical correlation coefficient (r) between the two sets.

Autry, L. National Environmental Laboratory Accreditation Conference, By Laws, and Standards. Research Triangle Park, NC: U.S. Environmental Protection Agency 2003. EPA/600/R-03/049 (NTIS PB2003-107268) , <http://www.epa.gov/nerlesd1/trc/publications/home3.htm>.

5/5/2003

Contact: Lara P. Autry

Abstract: NELAC is the result of a joint effort by EPA, other federal agencies, the States, and the private sector that began in 1990 when EPA's Environmental Monitoring Management Council (EMMC) established an internal work group to consider the feasibility and advisability of a national environmental laboratory accreditation program. The work group concluded that EPA should consult with representatives of all stakeholders, by establishing a federal advisory committee. As a result, the Committee on National Accreditation of Environmental Laboratories (CNAEL) was chartered in 1991 under the Federal Advisory Committee Act. In its final report to EMMC, CNAEL recommended that a national program for environmental laboratory accreditation be established. In response to the CNAEL recommendations, EPA and State representatives formed the State/EPA Focus Group that developed a proposed framework for NELAC, modeled after the National Conference on Weights and Measures. The Focus Group prepared a draft Constitution, Bylaws and standards, which were published in the Federal Register in December 1994. NELAC was established on February 16, 1995 by State and federal officials with the adoption of an interim Constitution and Bylaws. NELAC was established as a standards-setting body to support a National Environmental Laboratory Accreditation Program (NELAP). The goal of NELAP is to foster cooperation among the current accreditation activities of different States or other governmental agencies. NELAP seeks to unify the existing State and federal agency standards, at minimum cost to the States, federal agencies and accredited laboratories.

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Presented Published

SYMPOS/CONF

Daughton, C.G. Environmental Stewardship of Pharmaceuticals - The Green Pharmacy.
Presented at: The National Ground Water Association (NGWA) 3rd International Conference on
Pharmaceuticals and Endocrine Disrupting Chemicals in Water, Minneapolis, MN, March 19-21,
2003. EPA/600/A-03/059,

3/19/2003

Contact: Christian G. Daughton

Abstract: The occurrence of pharmaceuticals and personal care products (PPCPs) as environmental pollutants is a multifaceted issue whose scope continues to become better delineated since the escalation of concerted attention beginning in the 1980s. PPCPs typically occur as trace environmental pollutants (primarily in surface but also in ground waters) as a result of their widespread, continuous, combined usage in a broad range of human and veterinary therapeutic activities and practices. With respect to the risk-assessment paradigm the growing body of published work has focused primarily on the origin and occurrence of these substances. Comparatively less is known about human and ecological exposure, and even less about the documented or potential hazards associated with trace exposure to these anthropogenic substances, many of which are highly bioactive and perpetually present in many aquatic locales.